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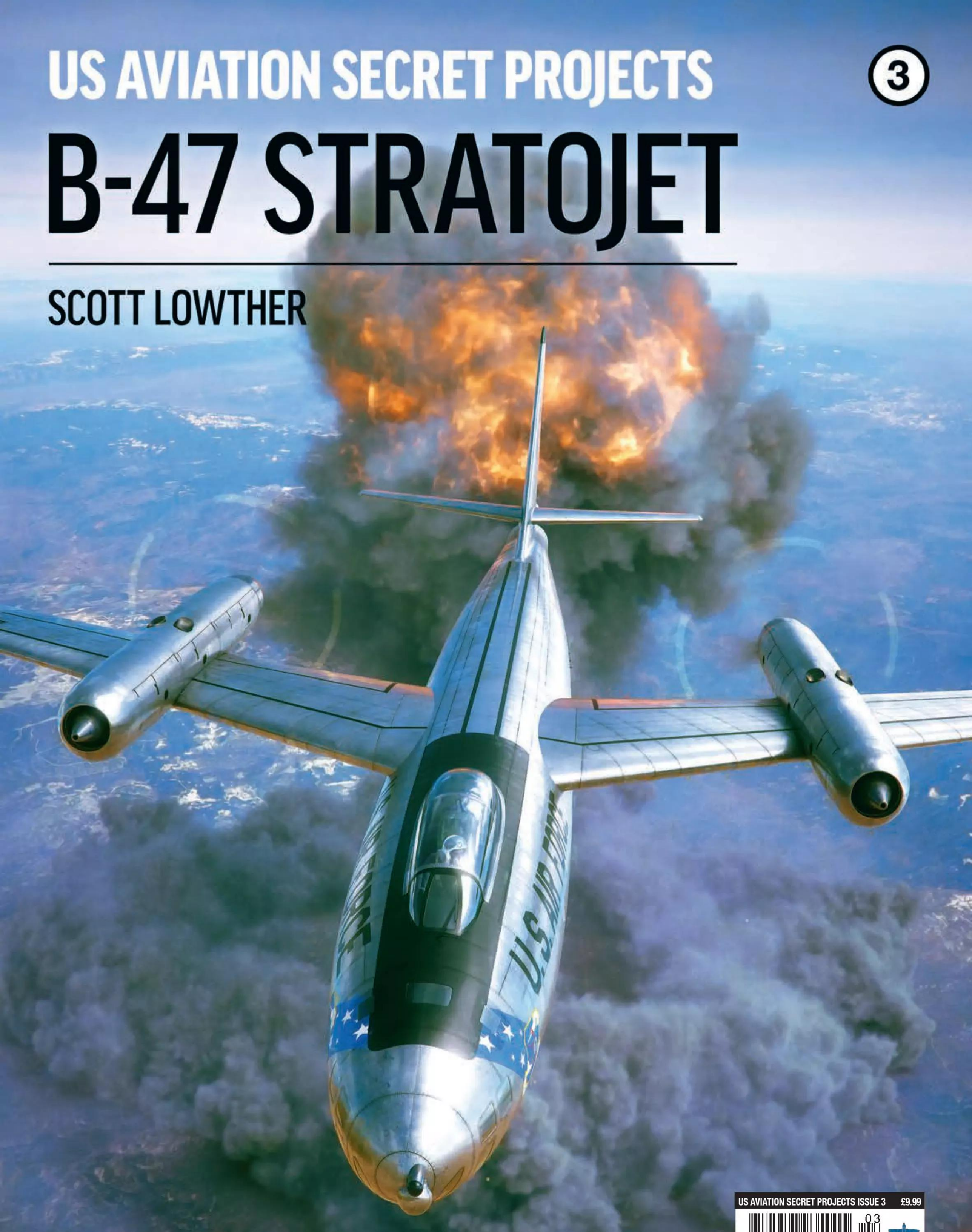
3

B-47 STRATOJET

SCOTT LOWTHER



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Introduction

The Boeing B-47 Stratojet was not the first Jet bomber; it was not even the first American jet bomber, but it was the first great jet bomber. Combining the best of British jet engine innovation, German aerodynamics and American know-how, it resulted in an aircraft that changed the world. Its service life was not long-lasting, certainly not compared to the aircraft that most directly benefited from its example, the Boeing B-52 Stratofortress, but it did set the pattern not only for jet bombers but also military and civilian passenger and cargo transports. Nearly 80 years after it was designed, the layout of the B-47 remains very nearly the standard.

The following work summarizes the evolution of the B-47 from predecessor concepts during the Second World War for jet propelled bombers and attack aircraft, through designs that competed against the Boeing Model 450 to become the XB-47. Beyond that are here described many derivatives of the B-47, built and unbuilt, obvious and bonkers. The B-47 straddled several important eras, technological innovations and outright fads in aviation, and Boeing, like any sensible company, strove to keep up and make a role for their aircraft.

Many of the designs included here were studied at best tentatively; others have had their documentation and diagrams sequestered and little has become available. Nevertheless I've done my best to render all of them in a consistent and quality manner, striving first for accuracy, second to make the illustrations look good. It's important for the reader to be confident in just how accurate the diagrams are, so to that end all drawings will have an indication of the 'reliability' of the drawing through a simple grading system, 1 through 5, given in the main data table.

- A 'source grade' of 1 indicates that the drawing is provisional, based on text description.
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Scott Lowther
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CHAPTER 1

Early American Jet-Propelled Bomber Development

The Second World War was, as has been pointed out innumerable times over the decades, a time of rapid and astonishing scientific and engineering advancement. Virtually every technological aspect of war underwent massive and irrevocable change. The war began with fabric-covered biplanes and horse-mounted cavalry still in service and ended with rockets flying into space and portable stars appearing in the skies of unfortunate cities.

Bombardment aircraft first appeared prior to World War One and were an established feature of modern military forces before the outbreak of the Second World War. But in a few short years those aircraft, which had initially seemed to be at the leading edge of science and technology, would be relegated to boneyards and museums.

Two of Boeing's most famous wartime aircraft were the B-17 and B-29 bombers. While the B-17 – a product of the mid-1930s – was certainly an aircraft worthy of merit, the B-29 was something else entirely. With a pressurised fuselage and an analog computer control system for remotely controlled machine gun turrets, the B-29 was the very definition of 'futuristic'. Add in the fact that it was the first aircraft armed with nuclear weapons and the B-29 seemed nearly science fiction come to life. However, as advanced as the B-29 was at the time, the propulsion system was entirely conventional… four radial piston engines driving four propellers. When the B-29 was originally designed in 1939 there were no practical alternatives. Turbojet engines were in their infancy and rockets had laughably poor fuel efficiency. But as the war went on, jet engine technology leaped ahead, progressing from vague notion to practical reality.

The British Power Jets WU centrifugal flow turbojet was first run in 1937 and further developed into the Power Jets W.1, the first British turbojet to power a flying aircraft, the Gloster E.28/39. It was not, however, the first turbojet aircraft to fly: that honour belonged to the German Heinkel He 178. The Heinkel first flew on August 27, 1939, while the Gloster first took to the skies on May 15, 1941. At that time, the United States had no official turbojet engine or jet-propelled aircraft programmes in active development. The Lockheed L-1000 axial flow turbojet was promising, but was at a preliminary level of development and had little official backing.

In April 1941, Major General Hap Arnold of the US Army Air Forces visited Britain and witnessed flights of the Gloster E.28/39. The technology impressed him enough that the following month he made an official request of the British to share the technology. General Electric was selected to produce a version of the W.2B/23 engine (a more powerful engine than the W.1, refined and put into production to power the Gloster Meteor fighter) as the J31. This was successful and the engine went on to power early American jet aircraft such as the Bell P-59 Airacomet and Ryan Fireball. This early engine was too small to power a bomber-sized aircraft, however.

In 1943, General Electric began development of a new engine entirely of its own design. The TG-180 was to be an axial flow turbojet, an all-around better form of turbojet than the centrifugal flow J31 and its successor the J33. Thrust was substantially higher than the J31… high enough that it could be reasonably envisioned as a bomber engine. As the TG-180 design was finalized, it received a military designation as the J35 and the design was provided to aeronautical companies so they could design aircraft that could use it.

As with any new technology, it took a while to get it right.

Boeing Model 413

Boeing of course jumped on the TG-180. The earliest known Boeing design to make use of this new engine was the Model 413, designed in response to an October 1943 request for proposals (RFP) for a jet-powered photo reconnaissance plane. Model 413, assigned in November 1943 and finalized in early 1944, was more or less a scaled-down B-29 configuration with one dual-jet pod under each straight high aspect ratio wing. The fuselage was somewhat smaller in diameter than the B-29 (8ft rather than 9ft 6in), so the pilot – there was no dedicated co-pilot station, rather a radio operator/gunner who could take the pilot's place – was given a raised canopy. It does not appear that the Model 413 was armed with either defensive or offensive weapons. But in order to perform its reconnaissance role, it was equipped with a small bomb bay containing six M46 photoflash bombs. These devices contained 25lb of flash powder which would burn for 0.20 seconds producing a peak light intensity of 500,000,000 candlepower. This was sufficient to light up a ground target at night for photography.

0 5 10 M

0 10 20 30 Ft

Lockheed P-80 to scale

Boeing Model 413

SCALE 1/220

Boeing B-29 to scale

Unfortunately, performance details such as speed and range are not currently available. However, it can be surmised by the lack of a co-pilot that flight durations were reasonably short; doubtless speed was relatively high for the time and range was relatively lacking. A wind tunnel model of this configuration was tested, sans canopy. While an early design for a large jet-propelled aircraft, it was surprisingly elegant in appearance.

Boeing Models 422, 424, 425, 426

When the Model 413 was submitted in January 1944 the USAAF's requirement for fast photoreconnaissance planes had already gone to the Hughes F-11 and the Republic F-12. But the Model 413 showed promise and with the prompting of staff at Wright Field the idea was continued with an eye towards becoming a true bomber. Four preliminary aircraft designs were produced in March 1944. Unfortunately, available data on these designs is minimal, though the informal request from the USAAF for a jet bomber called for a top speed of 500 miles per hour, a range of 2,500 to 3,500 miles and a ceiling of 35,000 to 40,000ft with an offensive payload of sixteen 500lb bombs. Four designs were produced at one time, the Models 422, 424,425 and 426. Curiously, the Model 423 was an unrelated low-cost transport design.

The first result of this new phase of study was the Model 422 which used the basic design of the Model 413 but with the four turbojets replaced with two turboprops. It's not clear what turboprop engines these were, but they were meant to power contra-rotating six (total) bladed propellers. This would have resulted in a lower top speed than Model 413, but increased fuel efficiency and likely increased payload and gross weight. This allowed for a meaningful bomb load to be carried within two fuselage bomb bays. Additionally, Model 422 was to be fitted with defensive guns in the nose and tail, unlike the apparently unarmed Model 413. The tail turret was much like that of the B-29, while the nose turret included a small, raised bubble canopy for the gunner ahead of the pilot's canopy. The aircraft had a tricycle landing gear arrangement with the main landing gear folding up into the fairings aft of the turboprops.

Model 424 was configured much like Model 413 but was reduced in size, the fuselage dropping to 7ft in diameter and with shorter fuselage length and wingspan (each about 82% of the Model 413's dimensions). It retained the engines and nacelles of Model 413. The nose was substantially recontoured, the underside uplifted to give the bombardier a sizable flat panel of armoured glass to peer through. The diagrams seem to show that the pilot's canopy was a single blown piece with an escape hatch cut into the top. No defensive armament is in evidence, suggesting that the top speed was thought sufficient to keep it safe.

Model 425 used Model 422's modified Model 413 design, with the original Model 413's engine nacelles. In effect it was just the Model 413 turned into a bomber.

Model 426 took Model 424's configuration and replaced the jet engine nacelles with the turboprops from Model 422.

These early designs were not everything the Boeing engineers could have wished. They were essentially just the B-29 shape with jet or turboprop engines stuck on; the designs did not take best advantage of the new possibilities. Wholly new engines suggest wholly new applications, including new ways to integrate them into the airframe. Wind tunnel testing showed that the dual nacelle merged directly into the wing produced more drag than expected. So, the Boeing designers went back to the drawing board with a clean slate.

Boeing Model 432

Rather than having the turbojets hanging from the wings, in April 1944 the Boeing designers of Model 432 decided to try integrating them into the fuselage. This design, already dubbed XB-47 on Boeing paperwork, left the wings utterly clean, undisturbed by engine nacelles, inlets, exhaust and landing gear. The four TG-180 turbojets were lined up side-by-side on the upper surface of the fuselage, fed by a pair of shoulder inlets. The engines would exhaust along the upper surface of the fuselage, doubtless raising issues with heat and shear.

By September 1944 the fuselage had a rather bulbous nose (earlier artwork depicted the nose as pointed), a distinctly non-circular cross-section and a number of odd contours. The tail was very much in the family of the B-29. The result was an aircraft with a remarkably clean and aerodynamic wing, but a fuselage that looked like a mutant pig. It's a strange bit of engineering dissonance, where a wonderfully aerodynamic wing was married to a fuselage that seemed passionately opposed to clean airflow. Model 432 is just plain unfortunate to look at.

It was to be fitted with a manned tail turret with two .50 machine guns with 500 rounds each. The design bomb load was 8,432lb, but by offloading fuel the bomb load could be substantially increased to one 10,000lb bomb, or four 4,000lb bombs, six 2,000lb bombs, eighteen 1,000lb bombs or 24 500lb bombs.

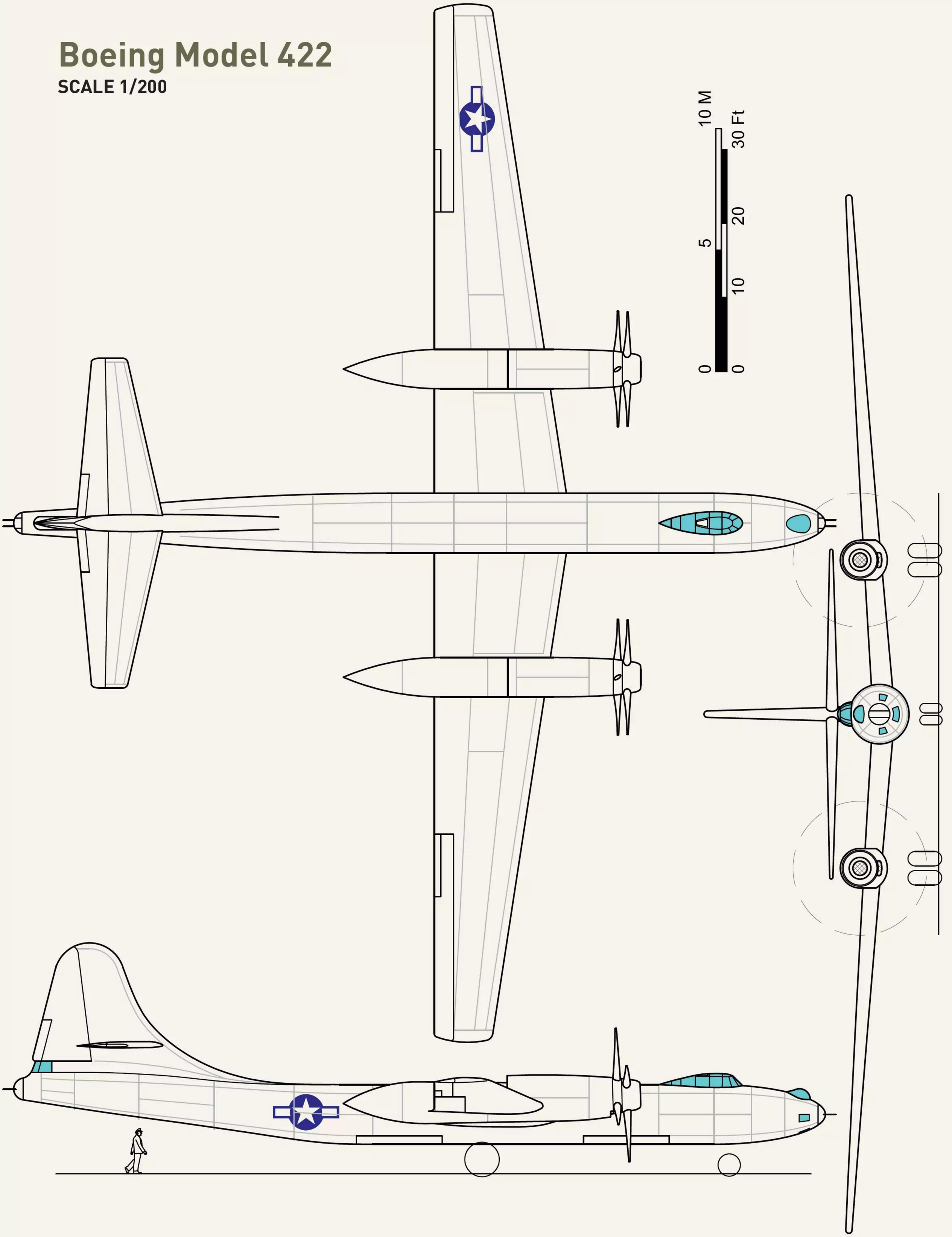
As odd as Model 432 seems today, in December 1944 Boeing submitted it to the USAAF. The design was approved and, in January 1945 it was officially given the military designation of XB-47 and funds were approved to begin development. Work on the B-47 was underway.

Model 444

In May 1945, Boeing designed two aircraft with the Model 444 designation. Model 444 Airplane 'A' was, as described in *US Aviation Secret Projects Issue 2: B-52*

Boeing Model 422

SCALE 1/200



Boeing Model 424

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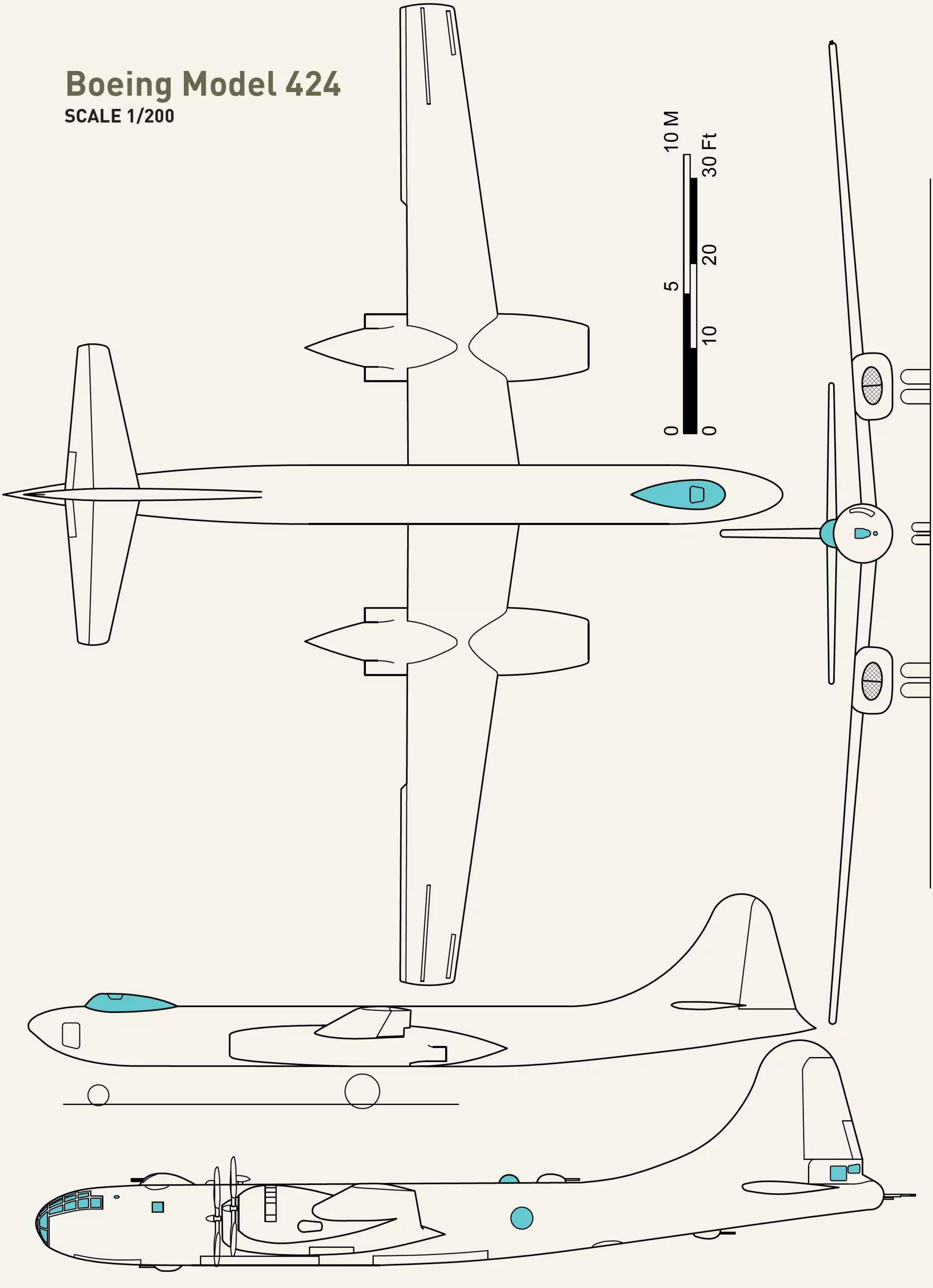

Boeing Model 425

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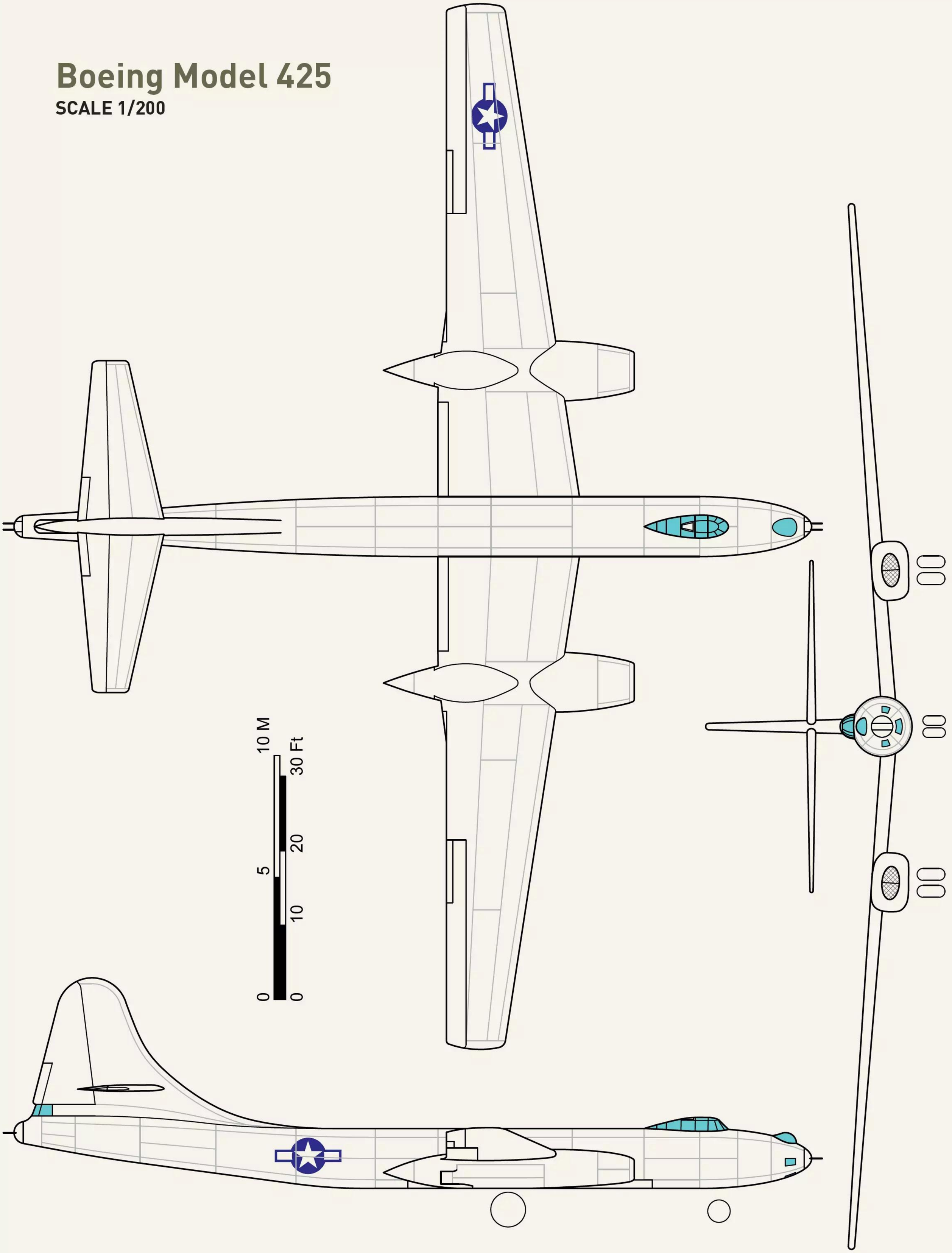
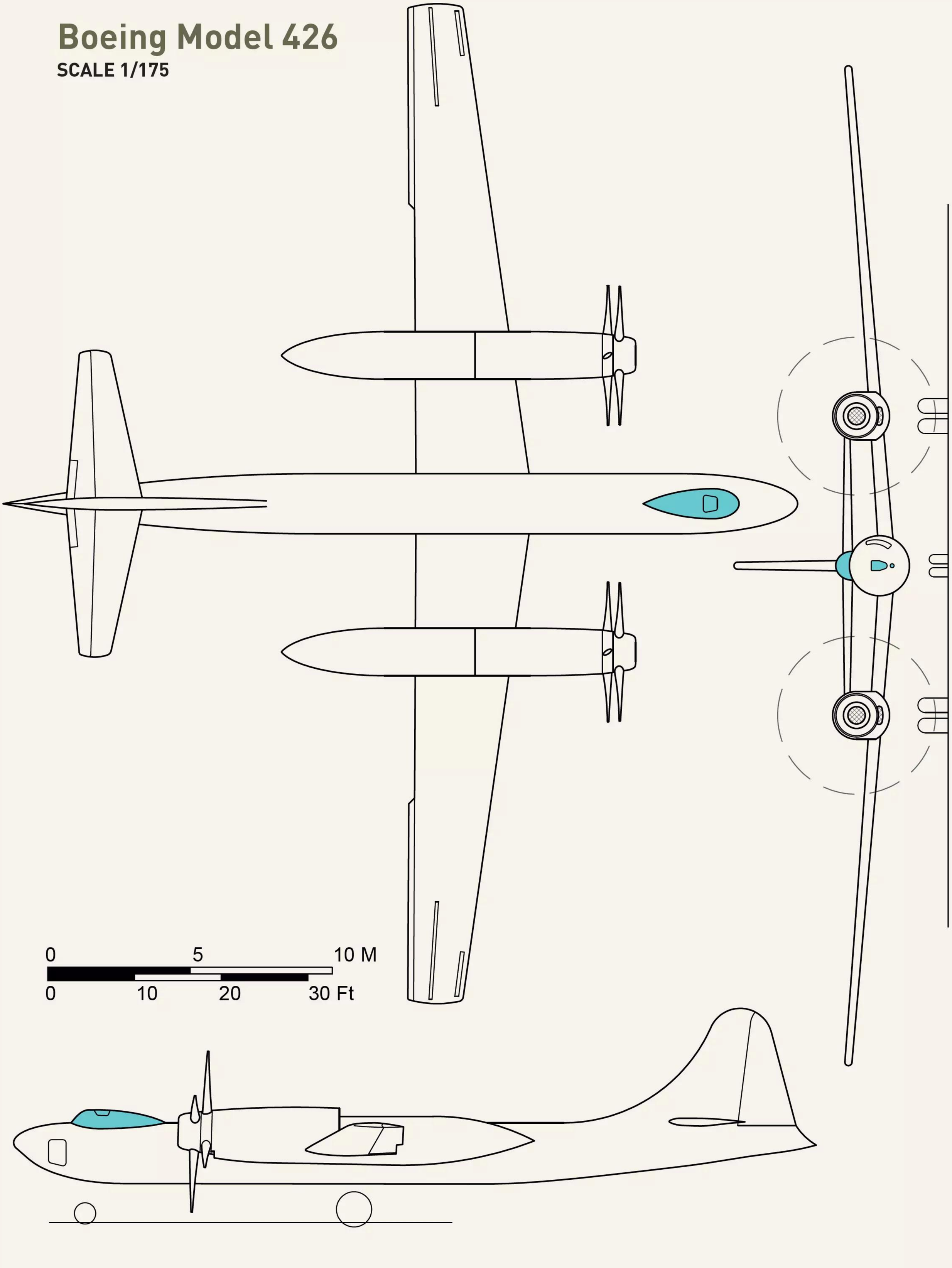


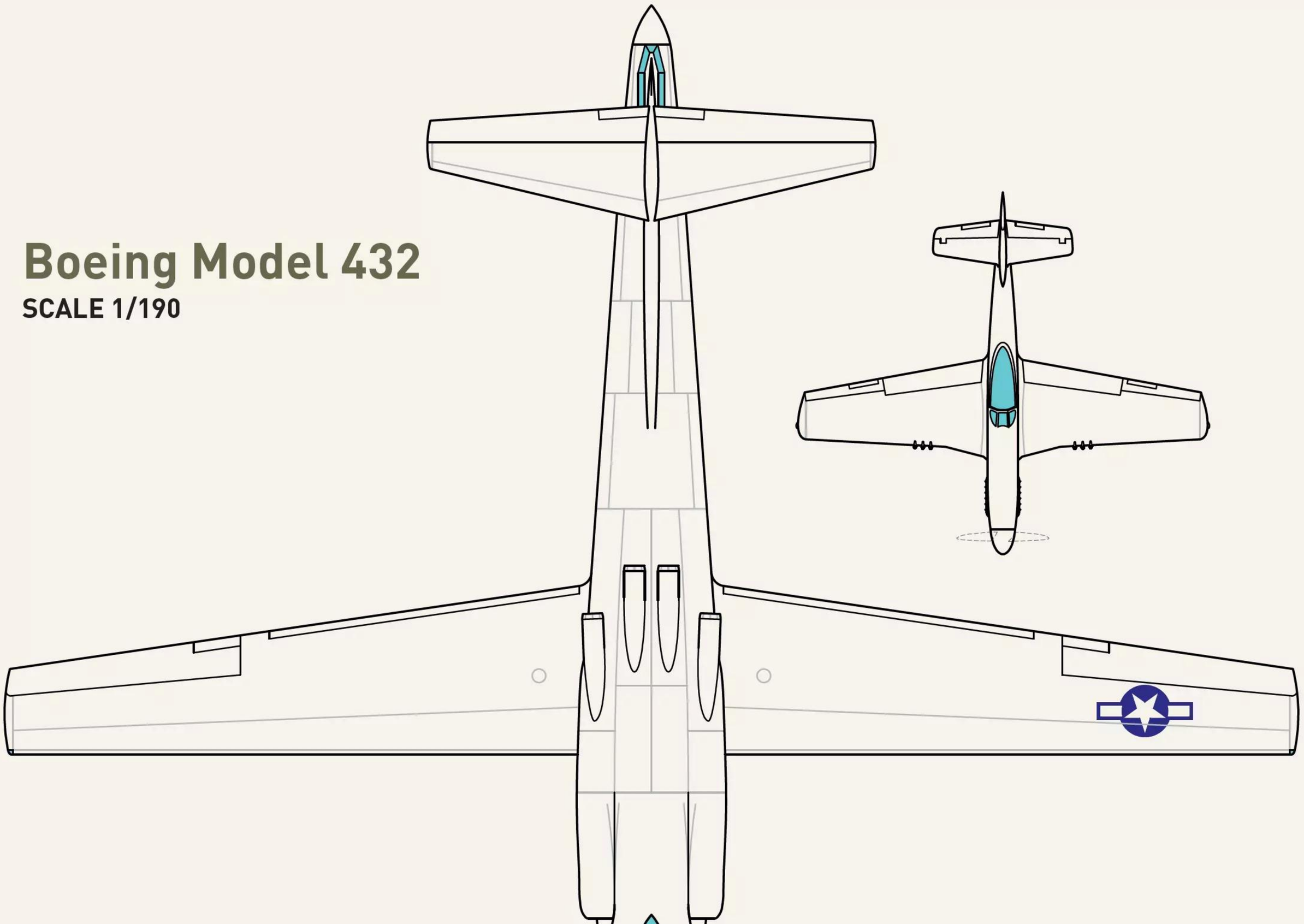
Boeing Model 426

SCALE 1/175



Boeing Model 432

SCALE 1/190

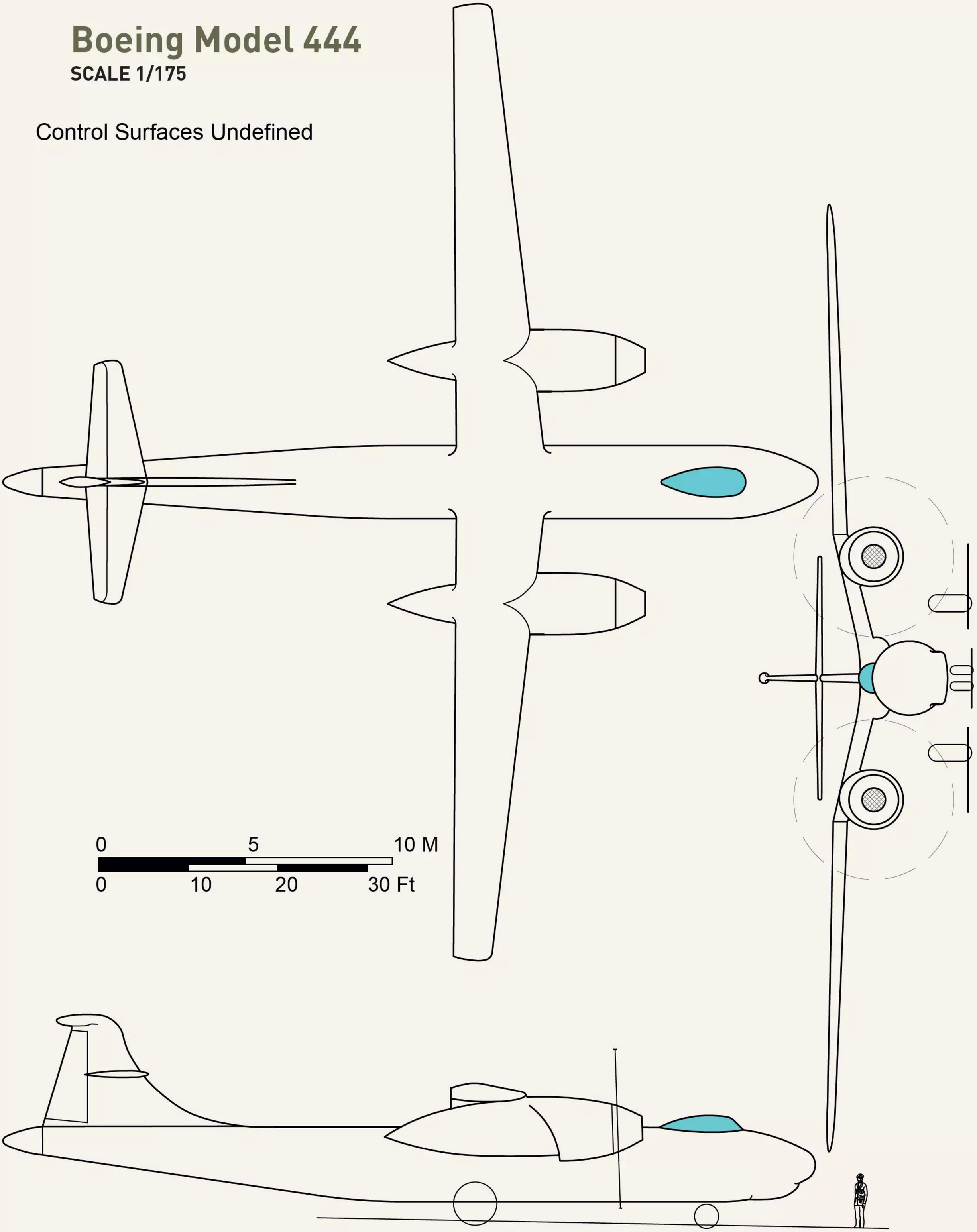


Provisional reconstruction,
April 1944 configuration
SCALE 1/190

Boeing Model 444

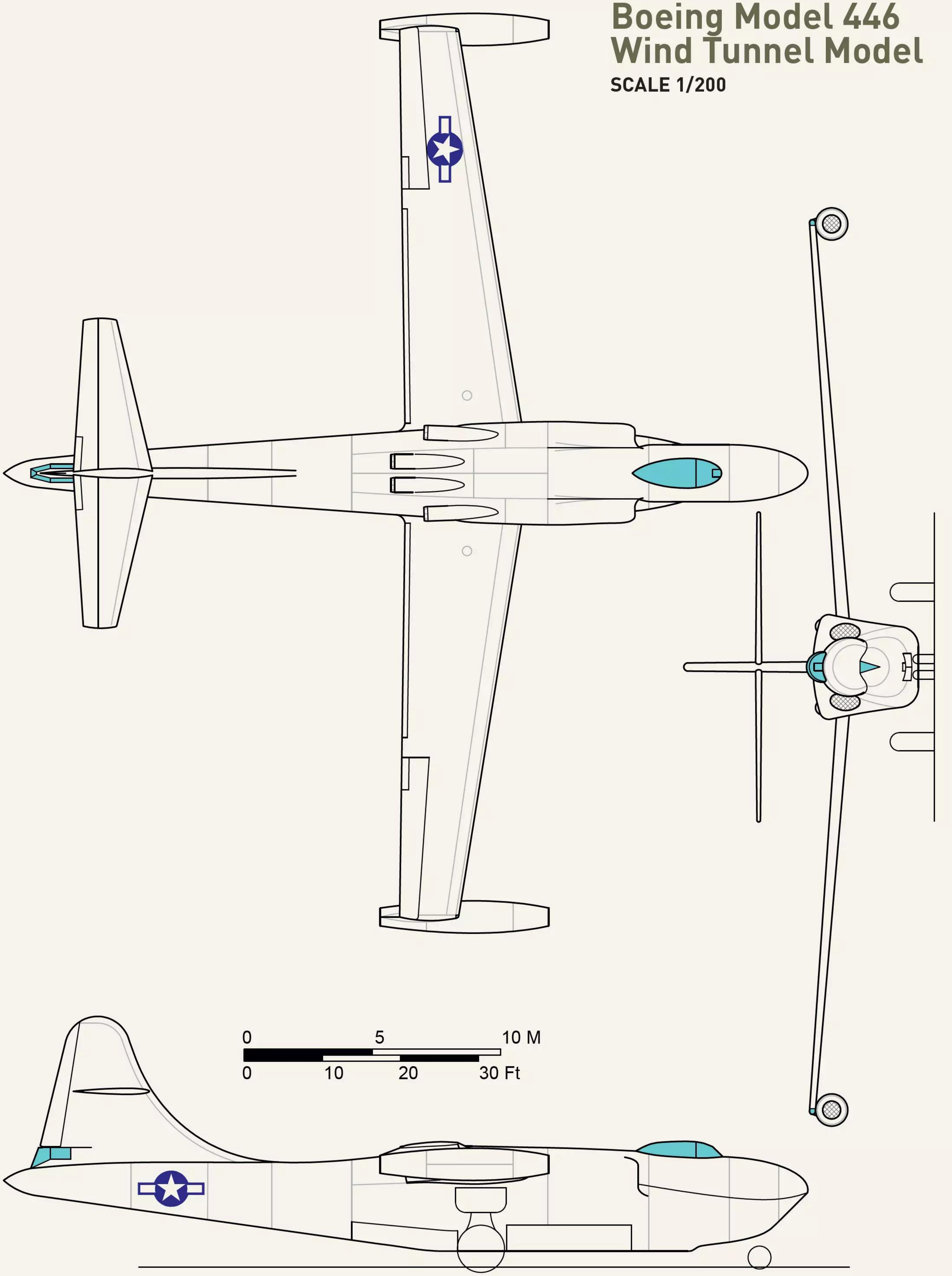
SCALE 1/175

Control Surfaces Undefined



Boeing Model 446
Wind Tunnel Model

SCALE 1/200



Boeing Model 446
Wind Tunnel Model

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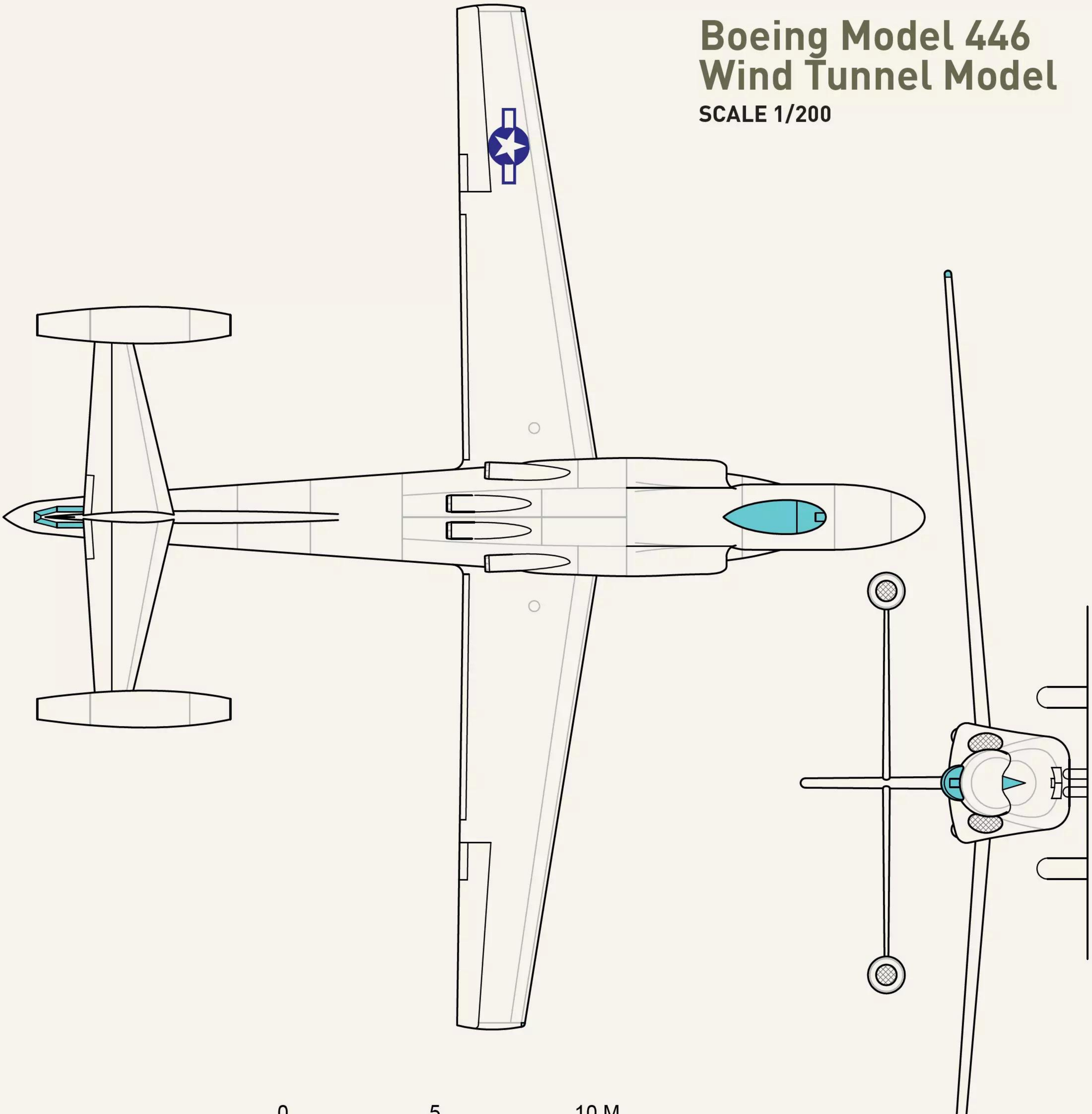
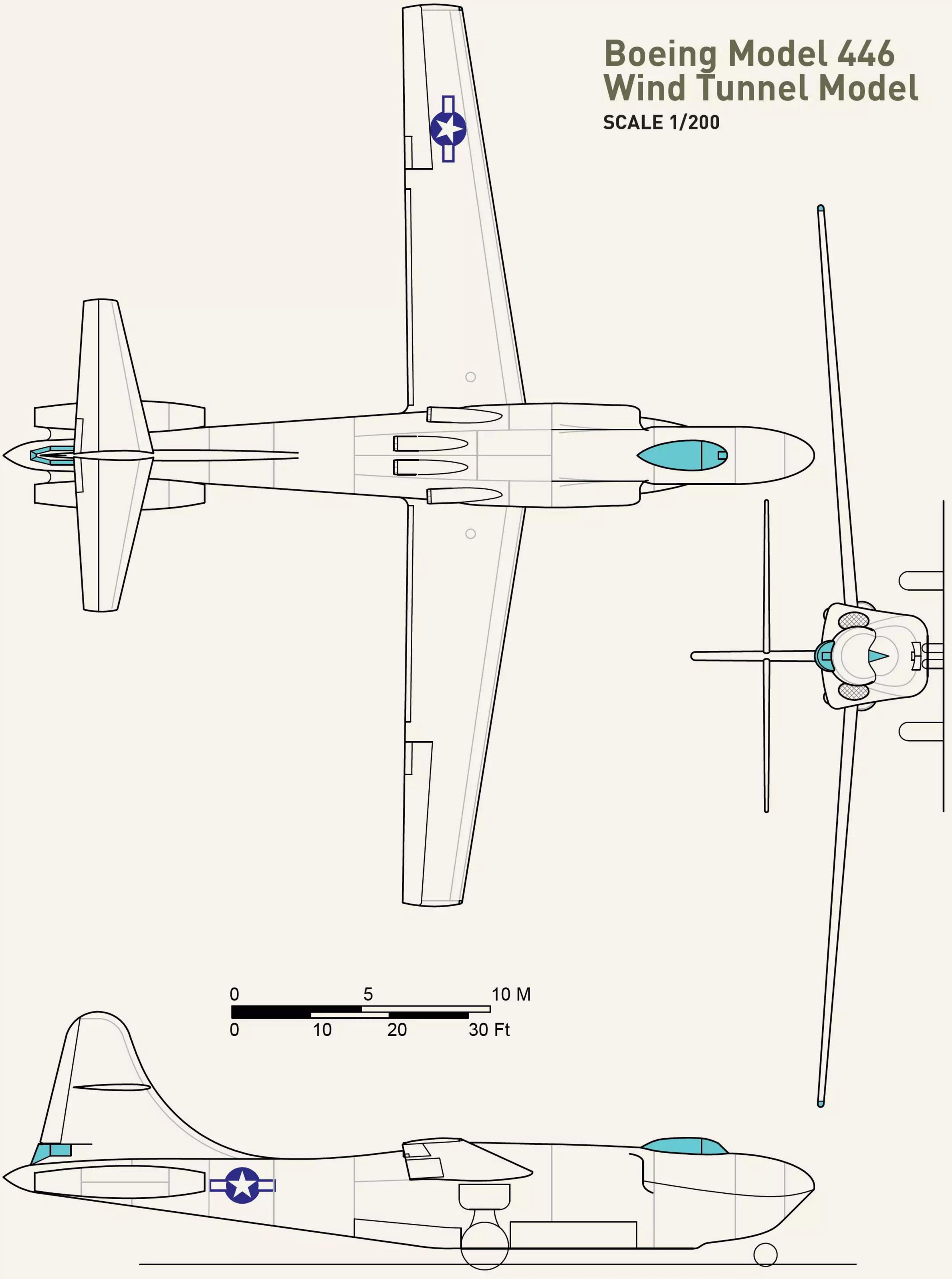


Boeing Model 446
Wind Tunnel Model

SCALE 1/200



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Stratofortress, a four-turboprop strategic bomber. Model 444 Airplane 'B' was a smaller design with two undefined (in the available exceedingly lean data) turboprops mounted to gull wings. The fuselage bore a distinct similarity to the coming model 450-1-1, which led to the B-47, while the wings were, apart from a planform similarity to Model 413, quite unique. It does not appear to have been designed in any great depth.

Boeing Model 446

Studies around the Model 446 are little known. This was a derivative of Model 432 with six turbojets rather than four; wind tunnel tests were carried out to study alternate locations for the fifth and sixth turbojets. Currently only photos of wind tunnel models are known, showing relatively large nacelles added to the wingtips, to the rear of the fuselage and another configuration with the same nacelles stuck on the ends of the horizontal stabilizers.

What advantage there would be in engines being in that position is unknown; perhaps it was thought that it would be useful from a weight balance point of view. Additionally, engines at the ends of the horizontal stabilizers would be closer to the aircraft centreline than wingtip engines. At this early stage in the development of jet aircraft, some design eccentricities can be forgiven. The need for two additional engines must have been clear as six engines became standard on XB-47 designs moving forward.

Things change

Within a few months, captured German data on high-speed aerodynamics started to become available to the designers of the XB-47. In April 1945, American forces liberated the German town of Völkenrode, a seemingly sleepy little burg valuable for one thing: the Hermann Göring Research Institute. There German aerodynamicists had carried out studies of high-speed aerodynamics and their data fell into American hands. At the time, those Americans included an aerodynamicist from Boeing.

A normal airfoil is relatively flat on the underside and rounded or humped on the upper side. Consequently, as air flows over the airfoil cross-section shape of a wing, it briefly speeds up. This increase in speed is correlated with a decrease in pressure. The difference between the higher pressure on the underside of the wing and the lower pressure on the upper side is what produces lift. This is all fine and good but as the aircraft's airspeed approaches the speed of sound, a slight increase in airspeed over the top of the wing can mean that the air is moving at or faster than the speed of sound relative to the wing. When this happens, drag can increase substantially as well as other unfortunate flow instabilities.

A way to delay this was discovered in the mid-1930s by German aerodynamicists Albert Betz and Adolf Busemann, professors of aeronautics at the University of Göttingen. When a wing is swept back, the development of a supersonic shock wave is delayed, so a swept wing at transonic speeds has notably lower drag than a straight unswept wing. When this fact was revealed by Betz and Busemann in a 1935 conference, few took much note as aircraft of the time were far from attaining transonic, never mind supersonic, speeds. But by the start of World War II that was a different story, and by the last year of the war the Germans were fielding aircraft that were dangerously close to transonic and seriously studying supersonic aircraft. The advantages of swept wings were thus of great importance and were highly studied.

German aerodynamicists had expended considerable time, effort and resources in studying models of wings of varying sweep and German aeronautical designers had begun to incorporate that information into their new designs. There are innumerable books, articles and websites describing – to variable degrees of accuracy – the designs of 'wunderwaffen' that the Luftwaffe was working on in order to dominate the skies, but it is undeniable that swept wings and their high-speed advantages were well understood. Many designs were produced to take advantage of that.

The German aeronautical industry cranked out a plethora of proposals for swept wing aircraft, both fighters and bombers, with wings swept modestly to sharply, aft and even forward. Many, perhaps most, of these designs were simply delusional: not necessarily on technological grounds, but by the end of the war Germany simply did not have the resources to truly develop, manufacture and field such fantastically advanced aircraft.

One swept wing bomber design that has become well known and which was doubtless made available to Boeing was a Focke-Wulf concept from August 1944 for a single-seat bomber. This aircraft, which has become known post-war as the 'Focke-Wulf 1,000 x 1,000 x 1,000,' was designed to carry a 1,000kg payload 1,000km at 1,000km/h. It had a sleek fuselage with complex curvature, but the more important feature was its distinctly swept wings. Swept-back wings were, as it turned out, the shape of the future.

The Focke-Wulf design had not only swept wings but swept tail surfaces. Additionally, the fuselage had a sudden reduction in width where the wings attached to it; this would have resulted in a form of 'area ruling' which also has definite aerodynamic advantages at high speed. It had two conventional turbojets just inboard of mid-span, hanging underneath the wings. The turbojets are notable for being angled outwards; this would have increased drag and slightly reduced effective thrust, but in the event that one engine failed – a not uncommon event with first generation jet aircraft – the remaining engine would have a better thrust vector and could thus propel the aircraft more effectively.

Focke-Wulf 1000x1000x1000 A
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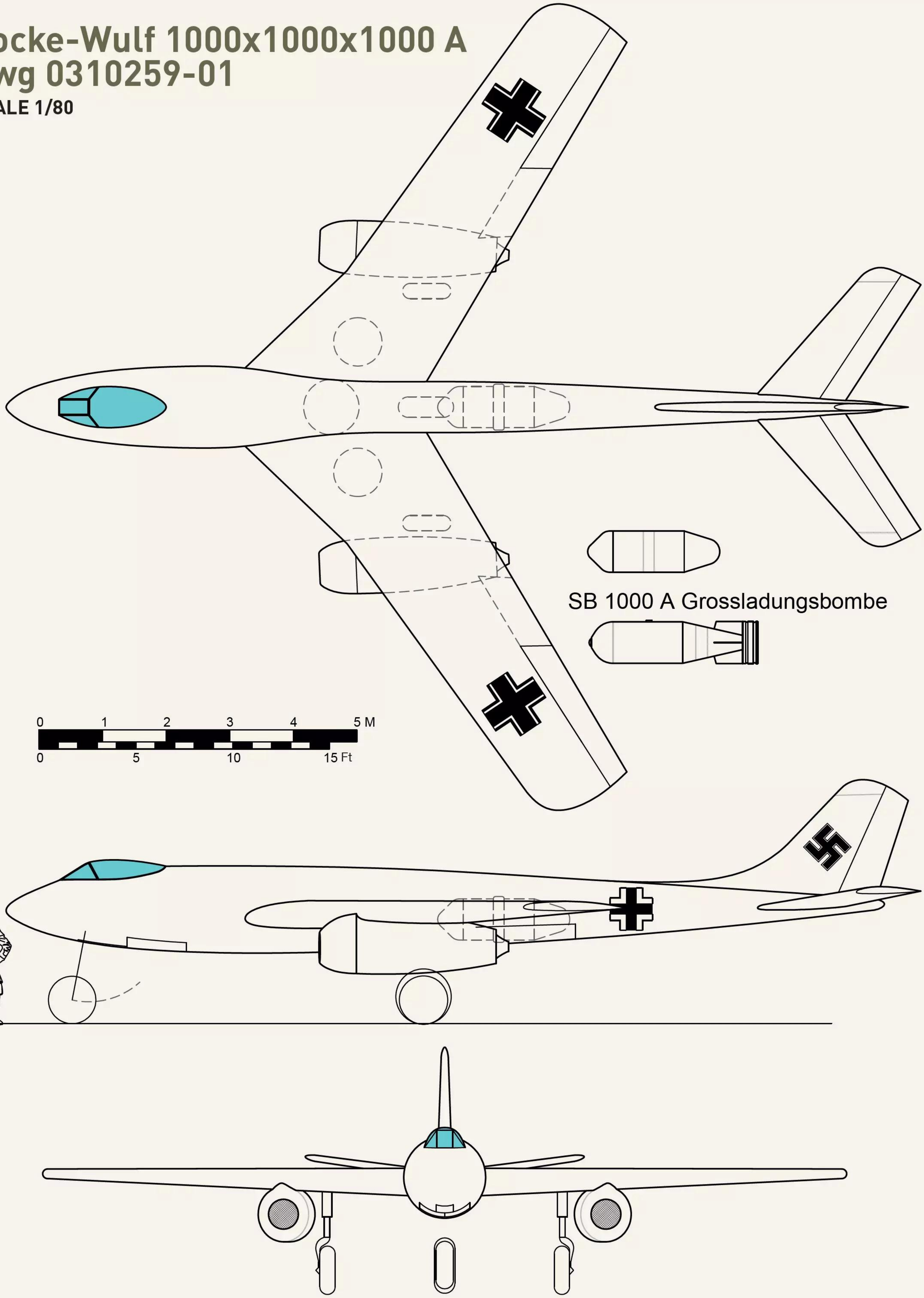
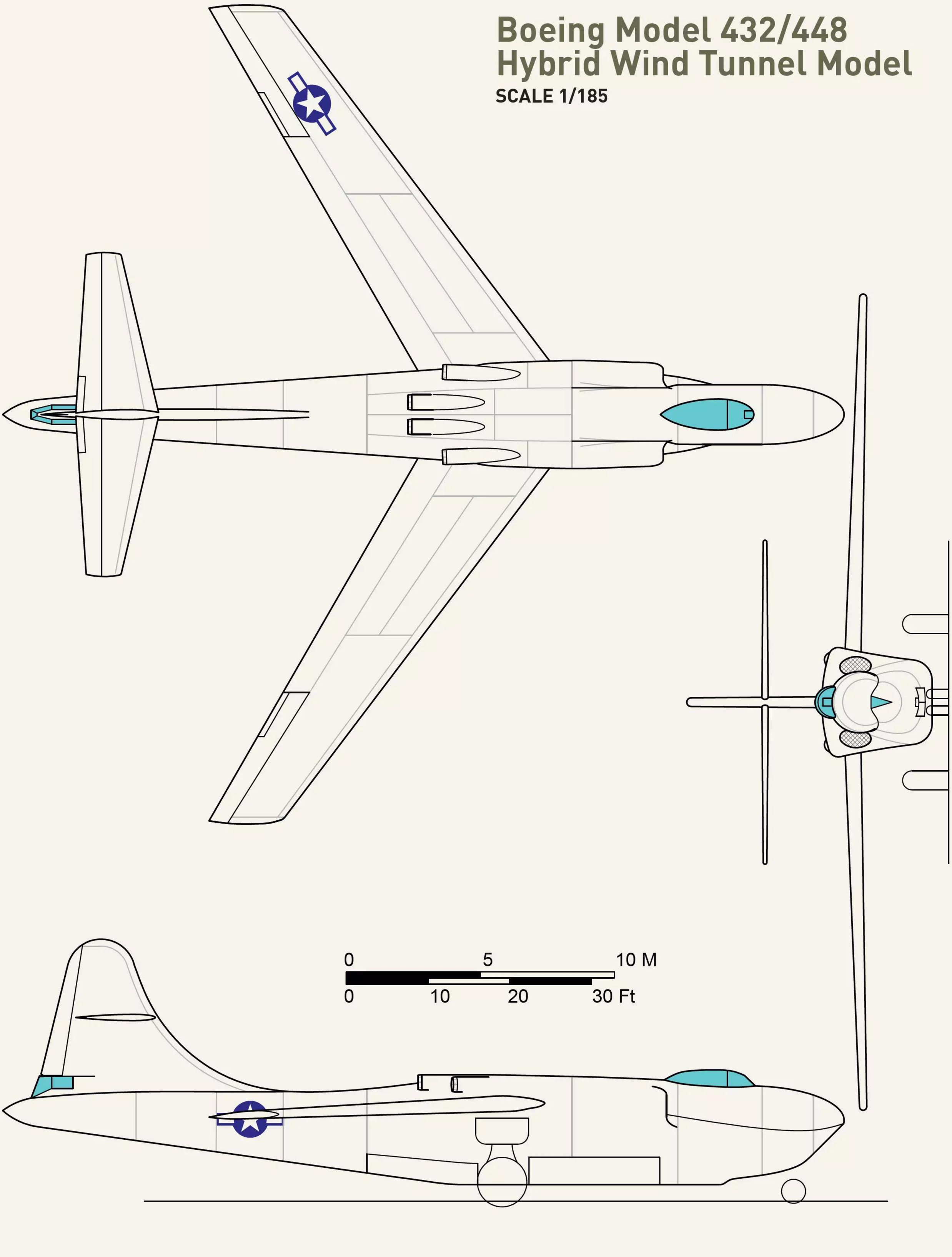
SCALE 1/80



Boeing Model 432/448
Hybrid Wind Tunnel Model

SCALE 1/185



The landing gear was unusual in that it had tricycle landing gear with the main gear folding up into the wing roots and the nose gear folding up into the nose of the fuselage… but a fourth wheel folding up into the central fuselage. This fourth wheel was slightly larger than the wing wheels and was presumably meant to take up the weight of the single SB 1000 bomb. The bomb was also unusual: apparently a modification of the existing SB 1000 A 'Grossladungsbombe,' the stabilizing fins seem to have been removed, presumably a result of limited space in the small aircraft's fuselage. Whether the bomb was meant to simply tumble or if it had other ways to aerodynamically stabilize is not known to this author.

This aircraft was designed at only a preliminary level, but its appearance and features were remarkably prescient. Numerous aspects of it would show up in the final B-47 design; whether or not these details were intentionally copied is unclear, but also unlikely. Boeing certainly made use of the data coming in from Germany, but Boeing – along with the National Advisory Committee for Aeronautics, other American aeronautical companies and various universities and scientific institutions – also carried out innumerable wind tunnel tests of their own. The German findings were not simply taken as divine revelation, but were proven and understood. The fact of aft-swept wing drag reduction was sufficiently important that the XB-47 went back to the drawing board in order to take advantage of it.

Swept Wing Model 432

A wind tunnel model of Model 432 was modified with swept wings. Based on photos, the wing used was probably an existing 432 wing, repositioned and with modified wingtips. The dihedral of the Model 432 wing was turned into a slight anhedral; the tail surfaces appear to have been unchanged. This model used the standard four engines of Model 432, not the six of Model 446. This may have been only a preliminary study to see what aerodynamic benefits could be had by changing an established design, rather than a serious engineering study.

Model 448

Model 448 from September 1945 was an outgrowth of Models 432 and 446. Aerodynamically and structurally refined from the earlier concept, Model 448 was built along lines previously established, but appears substantially more advanced and futuristic. Four of the 4,000lb thrust TG-180 turbojet engines were fuselage mounted just aft of the cockpit, in a position similar to those on the Model 432 (but substantially further forward) and two were mounted in the tail cone, similar to engines positions tested on Model 446.

The forward engines were fed by a common inlet in the nose, forming what looked like the gaping mouth of a whale shark. The inlet bifurcated, the division creating a passageway between the cockpit and the bombardier's position. The crew compartment was pressurized. The rear engines were faired into the tail, with the flush inlets being long and somewhat complex. This left the wings remarkably clean, swept aft as had been studied with the modified Model 432 model. The vertical stabilizer was still remarkably reminiscent of that of the B-29, but for the first time the horizontal stabilizers were also aft-swept.

Model 448 used a conventional tricycle landing gear arrangement, all retracting into the fuselage. To aid in navigation and accurate bombing a radar unit was located under the nose, just forward of the nose gear.

Defensive armament for the Model 448 included two .50 calibre machine guns in the tail (contained within a jettisonable tailcone equipped with radar scanner; the gunner controlled the guns remotely from the forward fuselage) with 600 rounds each. Offensive armament could be sixteen 500lb bombs, eight 1,000lb bombs or a single 22,000lb 'Tallboy' bomb.

Putting the engines on the top of the forward fuselage produces an immediately obvious problem: the jet exhaust blasting along the surface of the fuselage. Not only does this lead to the risk of structural damage through blast and heat, it also somewhat reduced engine performance. This odd design feature was inherited from the previous design, Model 432. The Army Air Forces were understandably skeptical of the concept. At this point in the development of turbojets, technology was advancing rapidly and new engine designs were being constantly proposed. If Model 448 had been built and new engines were introduced, integrating them into the airframe could have been problematic. And putting the engines atop the fuselage would have complicated maintenance, something early jets needed a lot of. Perhaps worse, if an engine were damaged – from bullets, shrapnel or simple mechanical failure – the engine would project flames and debris into the fuselage itself. Boeing had to go back to the drawing board. The fuselage-mounted engines were relocated to underwing pods in the Model 450… and the B-47 was born.

Model 450

The next design was a major step forward. Model 450-1-1 (still officially designated the XB-47), dating from October 1945, took the swept wing of Model 448 and married it to an entirely new fuselage. It had the same six engines as Model 448, but relocated them away from the fuselage: each wing had a dual-engine pod suspended beneath with a pylon and another engine stuck to the wingtip. With this design, the engine exhausts came nowhere near to impinging upon the aircraft structure. A catastrophically failed engine would also pose a much

Boeing Model 448

SCALE 1/200

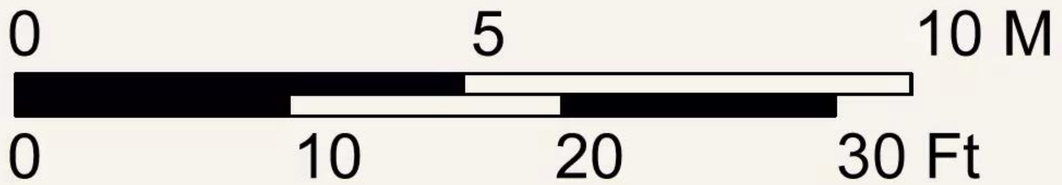
0 5 10 M

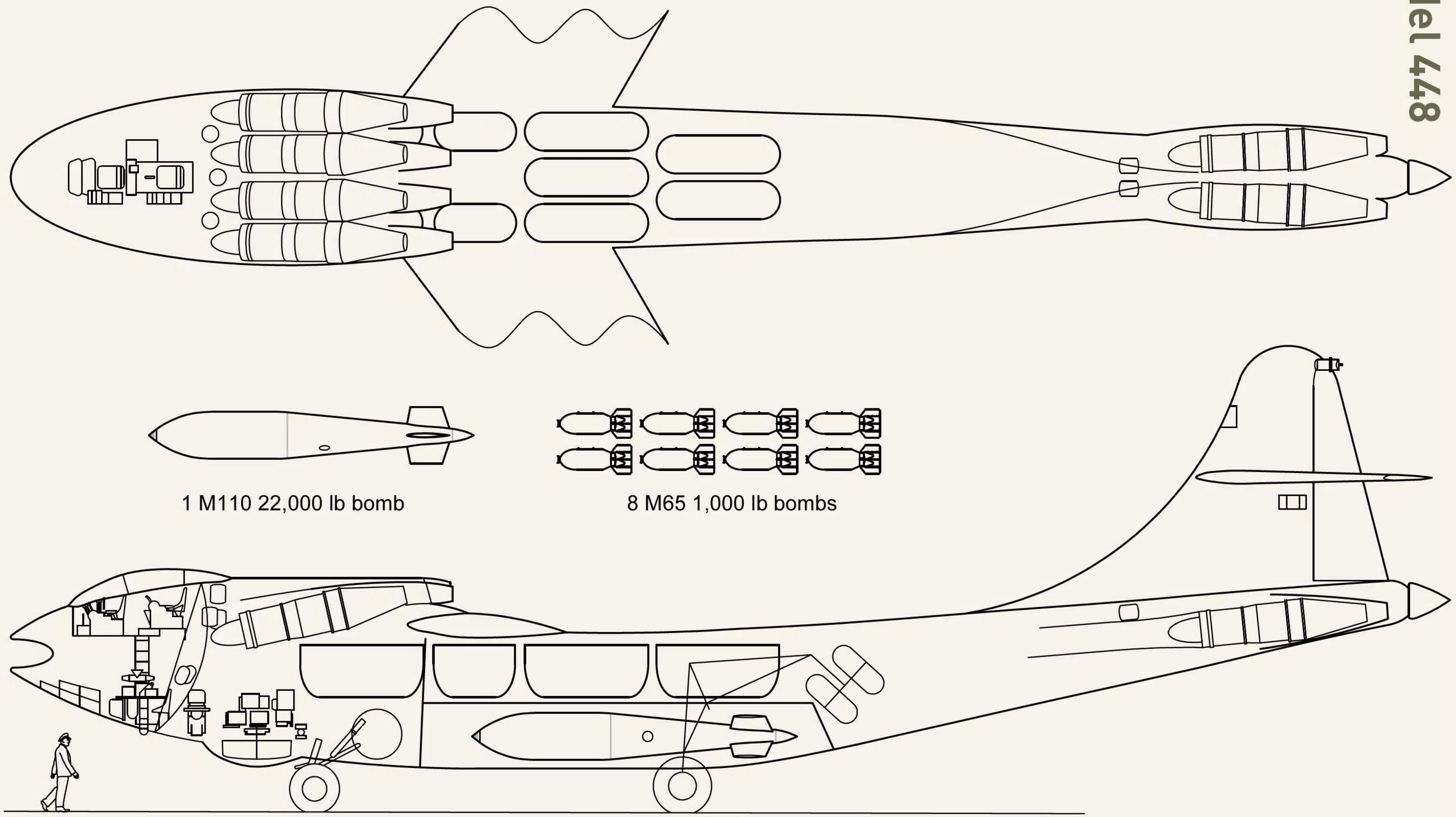
0 10 20 30 Ft

Republic F-84A to scale

Boeing Model 448

SCALE 1/144



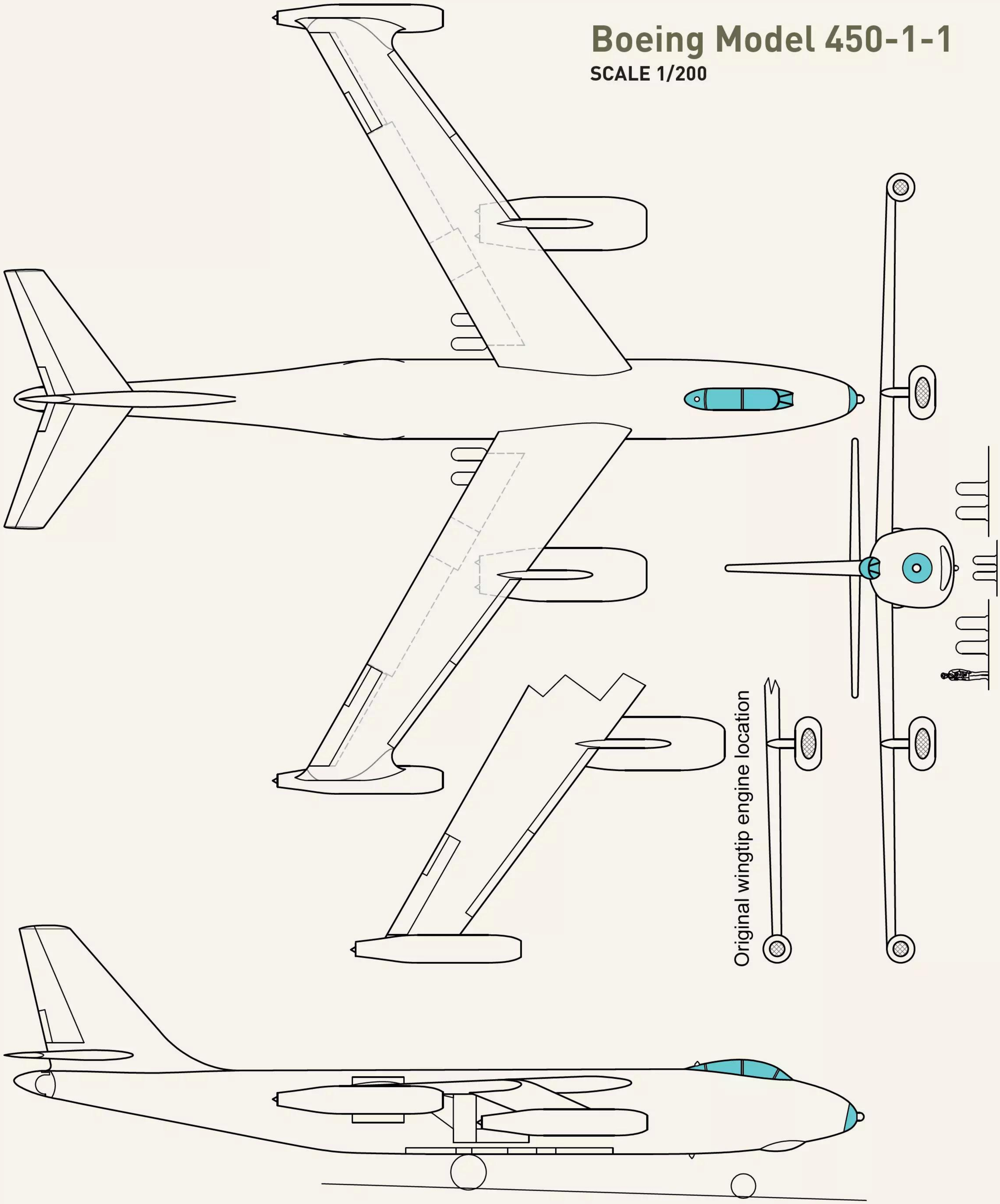


1 M110 22,000 lb bomb

8 M65 1,000 lb bombs

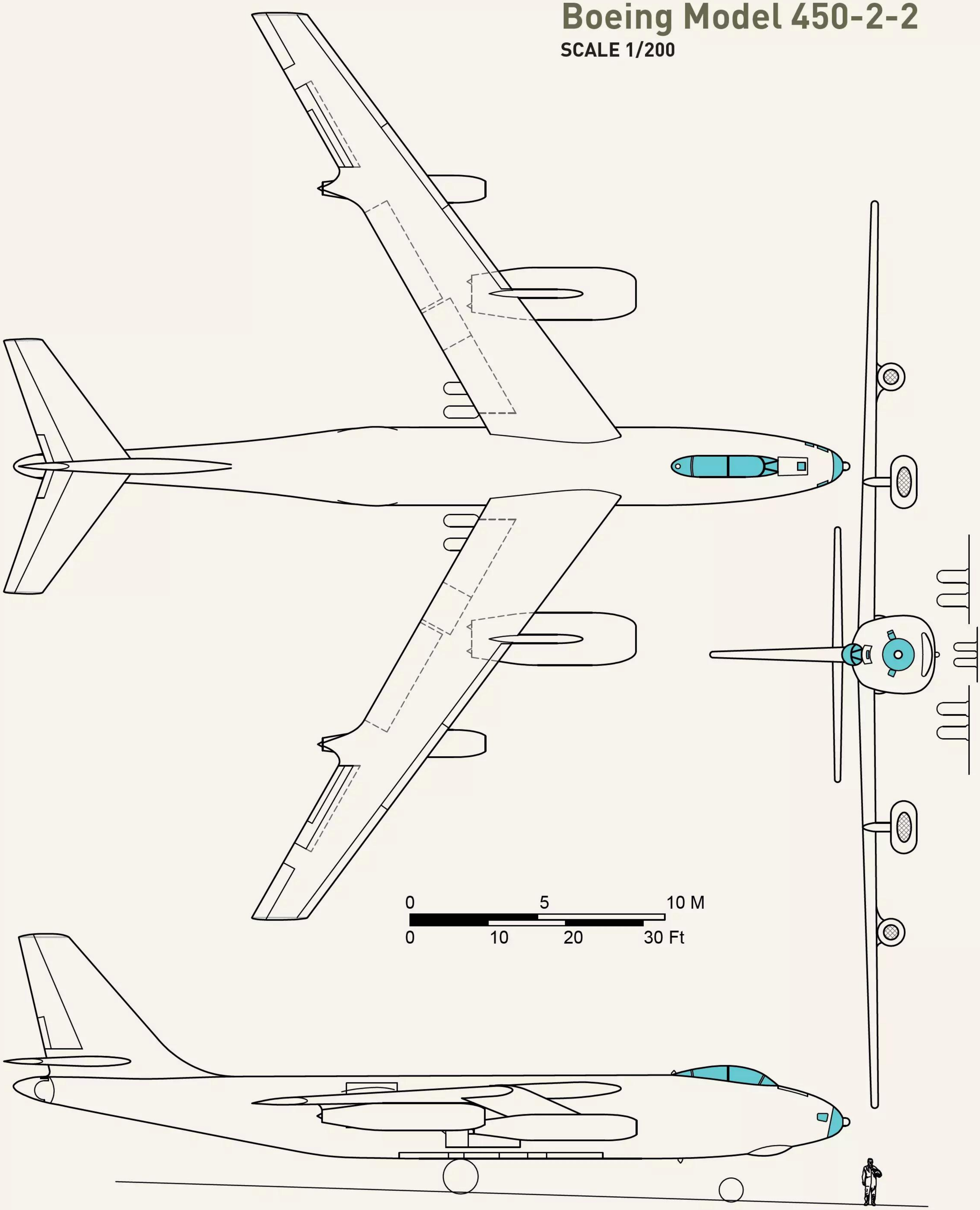
Boeing Model 450-1-1

SCALE 1/200



Boeing Model 450-2-2

SCALE 1/200



lesser risk to the aircraft, though the loss of a wingtip engine would of course create a definite thrust imbalance.

This engine arrangement had a structural benefit. The Model 448 wing was clean, with the only weight hanging from it being the fuselage. The wing was thus a single cantilevered beam, all of the weight concentrated at the wing root. But Model 450-1-1 suspended two engines and the associated nacelle and pylon at about the one-third span point, and another engine at the wingtip; this helped to spread the load across the span of the wing, modestly reducing the strain on the wing root. This advantage was especially important given that the wing of Model 450-1-1 was not only swept 37.5° but, compared to similarly sized but earlier bombers, very thin at 12%. The tail surfaces – ALL of the tail surfaces – were at last aft-swept as well.

Model 450-1-1 is clearly recognisable as the B-47. But it had a number of important differences from the aircraft that was eventually built, many as a result of the April 1946 inspection of the full-scale plywood mockup. It was generally well received by Army Air Forces personnel, but a few suggestions were made. In particular, the tricycle landing gear that Boeing had designed for Model 450-1-1 was complex, heavy and consumed substantial volume within the fuselage. In fact, it required so much volume that the fuselage could not contain the gear; blisters on the exterior surface showed where the main wheels projected through what would have been the undisturbed outer mold line. The fuselage was also of constant cross-section for a considerable length; this made construction easier, but was not aerodynamically optimal.

A single long bomb bay could contain multiple smaller bombs – or one giant 'Tallboy'. But instead of monolithic doors as long as the bomb bays, Model 450-1-1 was equipped with multiple shorter-length doors that would open as needed for the weapons being deployed. For defence, it had a remotely operated tail turret with two .50 calibre machine guns. The gunner was given a periscope above the forward fuselage (just at the rear of the raised cockpit canopy) and one directly below, projecting through the fuselage underside. A radar scanner was planned for eventual inclusion within the tail cone to aid in aiming.

Further examination showed that increased wing area was needed, so the span was increased by 16ft. This slightly increased range, but substantially reduced the takeoff run and raised service ceiling. As the wings were extended, the wingtip nacelles were moved to below the wings and somewhat inboard. These changes produced Model 450-2-2. Apart from the wing/engine changes and some additional windows on the nose, Model 450-2-2 appears little different from Model 450-1-1.

The next design iteration, unsurprisingly Model 450-3-3, incorporated the suggested changes and recent updates. The tricycle landing gear was dispensed with. Knowingly or not, the Boeing designers took another feature from the wartime Focke-Wulf design: Model 450-3-3 had a 'bicycle' landing gear arrangement. In Boeing's case, the new aircraft had a pair of conventional nose wheels, a pair of main wheels stowed in the fuselage slight aft of the midpoint, and quite small 'outrigger' gear which would deploy from the dual-engine nacelles. The outriggers were meant to provide stability on the ground rather than take up substantial landing loads.

The engine nacelles themselves changed. The length of the nacelle was reduced; the single elliptical inlet that fed both engines was replaced with two independent inlets. A fairing was added underneath the new inlet to stow the outrigger gear.

With the main landing gear simplified, the fuselage was refined. The change in contour was not extreme, but it did make the fuselage look more elegant. At last, the XB-47 had moved almost entirely away from its pre-jet-technology forebears. It was a modern, optimised jet-propelled aircraft. Compared to the piston engine bombers of World War II, it was gloriously futuristic. And as it turned out, the Boeing design was gloriously futuristic compared to its direct competitors too.

When Boeing's designers began looking at turbojet propelled bombers, they were hardly alone. Secret as the technology started out, the entire American aircraft industry wanted in. A number of designs, both realised and unrealised, were produced at about the same time as Model 450-3-3.

Douglas XB-43

Americas first jet bomber is somewhat perversely also one of its least known. The Douglas Aircraft Company, in an April 1943 private study, designed the Model 459. This was an unconventional piston engine bomber that had engines buried within the fuselage, driving contra-rotating pusher props at the rear of the fuselage via long drive shafts. To keep the props from striking the ground on takeoff and landing, the aircraft was fitted with a ventral fin as well as a normal dorsal one. Variants included a dedicated bomber with a glazed nose for a bombardier and a ground attacker with a solid nose packed with machine guns.

The resulting design was extremely aerodynamically clean and, when presented to the Army in May 1943 in an unsolicited proposal, was well received. In November that year, Douglas received a contract to build two flying examples and one static test article of the XB-42 (initially 'XA-42') Mixmaster. It was a remarkable aircraft. With two fully submerged Allison V-1710-125 engines it was capable of great speed and surprising performance; it was the size of a medium bomber but it could carry four 2,000lb bombs around 5,000 miles.

Douglas XB-43

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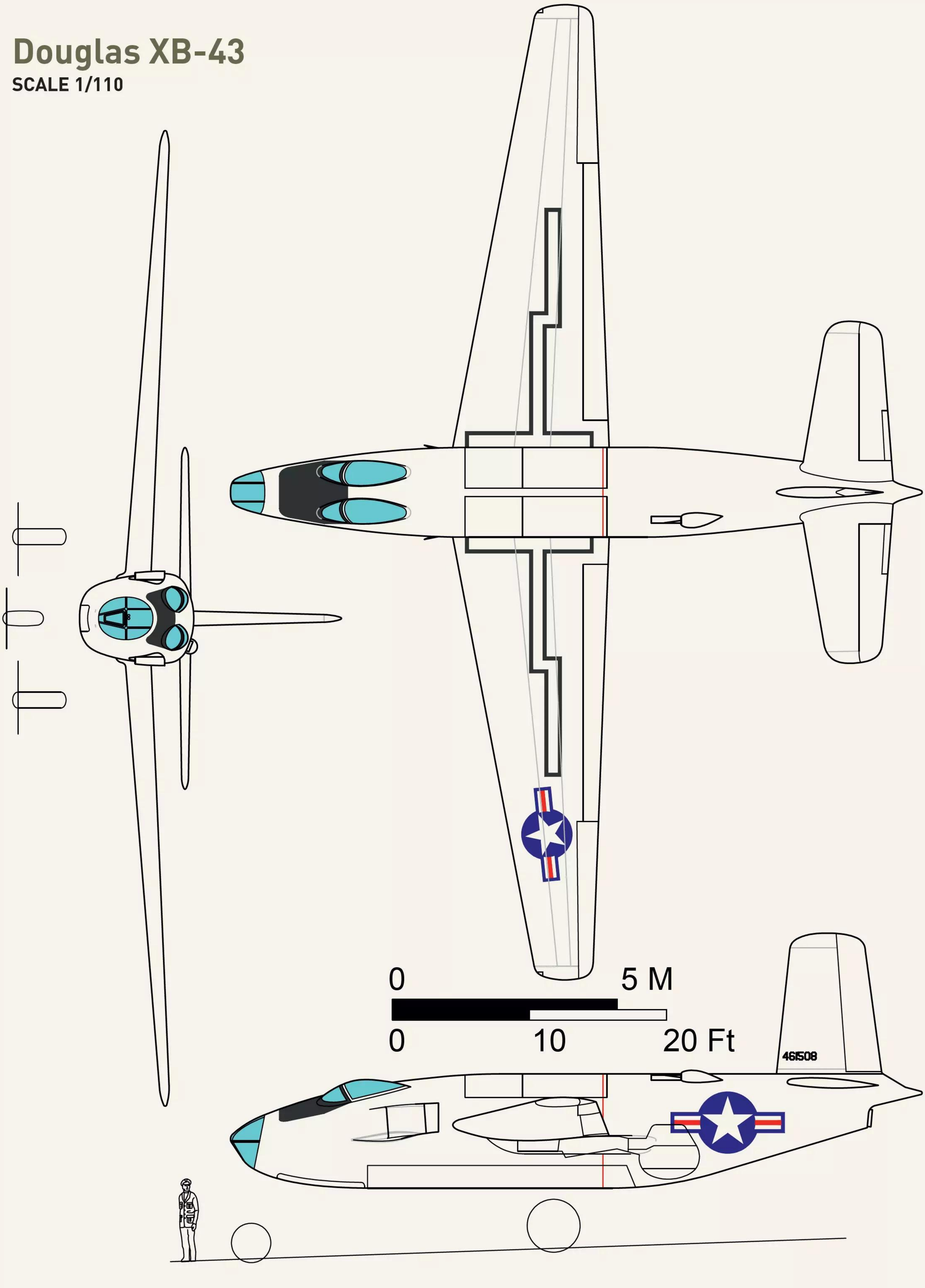
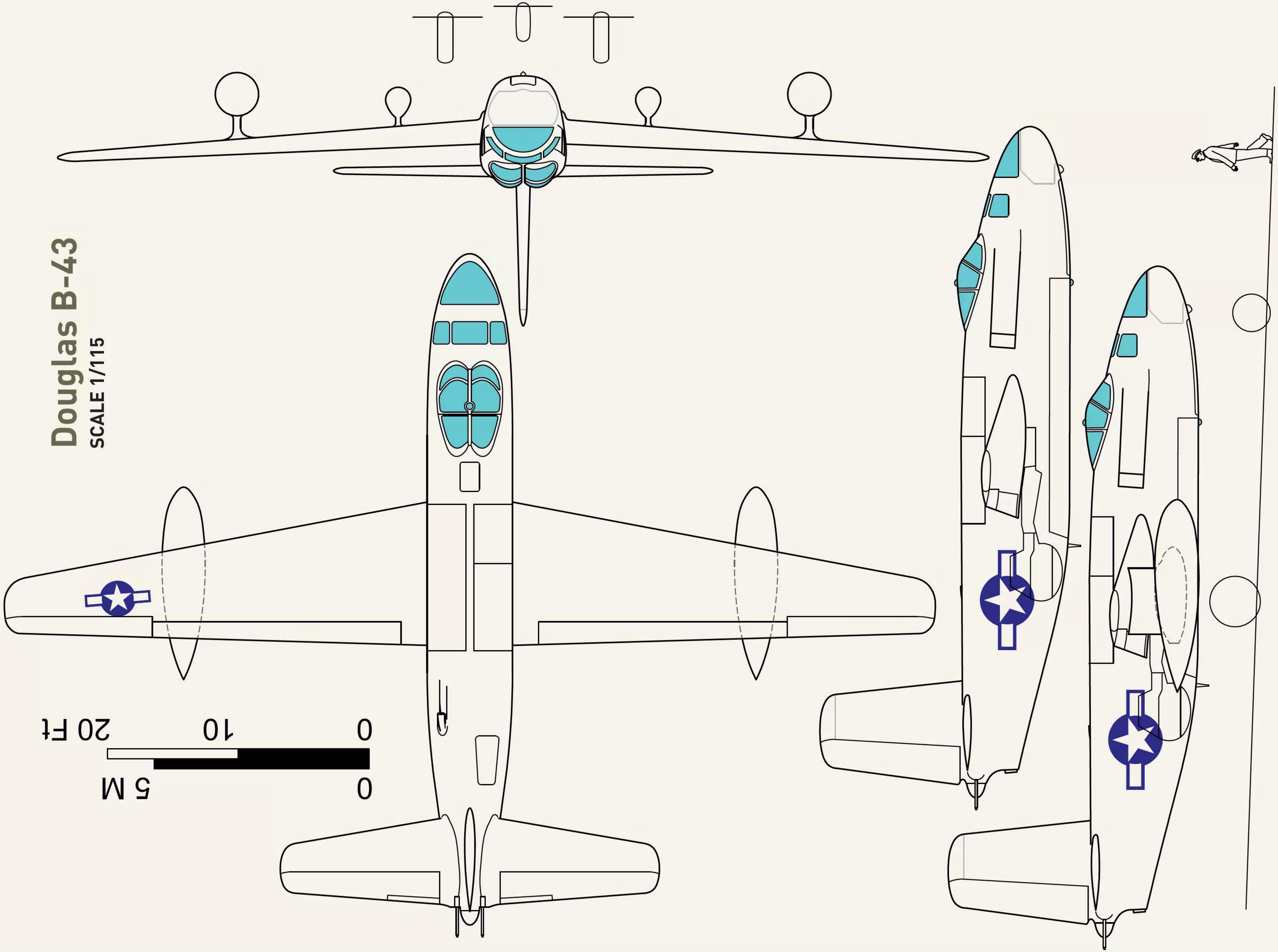


Douglas B-43

SCALE 1/115



The first prototype began flight tests in May 1944, the second in August that year. The two aircraft were visually distinguishable by their cockpit canopies: the first prototype had separate small 'bug eye' canopies of the kind that Douglas was at the time rather enamoured with, using them not only in several proposed concepts such as the B-31 strategic bomber but also on the first of the C-74 Globemaster cargo planes. As with the C-74, the separate canopies of the first XB-42 prototype proved low-drag, but also made communication between the pilots difficult. So the second prototype was equipped with a standard single canopy.

First flight occurred on May 6, 1944. Testing showed excellent speed performance, but difficulties with engine overheating. For defensive weapons, the B-42 was to have two .50 calibre machine guns in remotely-controlled trainable mounts approximate mid-span on the trailing edges of the wings; the aircraft was fast enough that forward-firing defensive weapons were seen as superfluous. Offensive ordnance would be carried in an internal bomb bay providing space for up to four 2,000lb bombs. Flights reached an impressive 410 miles per hour.

The XB-42 proved to be an advanced and promising design… but one that arrived simply too late. The skies were filled with adequate American bombers propelled by pistons and props; it was becoming clear that the future would soon belong to jets. So yet another piston engined bomber, even one as spectacular as the B-42 promised to be, seemed like yesterday's news.

In September 1943, the US Army requested that Douglas study converting the B-42 aircraft to jet propulsion. Several preliminary designs were produced in September 1944 showing the B-42 converted to full jet propulsion using two or three turbojets. In order to maximize commonality with existing B-42 production hardware, these designs put one turbojet beneath each wing, and up to one more engine in the tail with an underslung inlet. These designs were not proceeded with. However, in April 1945 – just as the war in Europe was coming to an end – the Army authorised Douglas to modify an existing XB-42 with one Westinghouse 19XB-2a (J30) axial-flow turbojet under each wing. This revised design was dubbed the XB-42A. Due to difficulties in procuring the engines, as well as the end of the war, the first flight did not occur until May 27, 1947. The added jets boosted top speed to 488mph, but added weight and imposed maintenance and vibration issues.

Douglas proposed a more radical modification: the XB-43 design emerged in January 1944, a B-42 design for pure jet propulsion, not constrained to maximize commonality. Consequently, two Allison TG-180 (J35) axial-flow turbojets were embedded within the upper fuselage behind the cockpit, just above the wing root. To fair them in, the upper fuselage was raised compared to that of the XB-42, also changing the upper nose geometry. The wing root engine inlets of the XB-42 were replaced with flush inlets on either side of the nose, running just below the cockpit canopies. The Army agreed and the B-42 static test article was sent back to the shop to be converted to full jet power. The piston engines removed, the tail structure modified, the ventral fin deleted (no longer needed to prevent props striking the runway), the dorsal vertical stabilizer enlarged, the development of the XB-43 Jetmaster proceeded quickly. But the jet engines – the same General Electric TG-180s that were to power the Boeing Model 413 and other designs – were slow to develop.

Douglas planned several types of operational B-43… a ground-attack version that had sixteen .50 calibre machine guns buried within the wings and 36 unguided rockets under the wings, and a bomber version with 6,000lb of bombs in an internal bay. Both versions would have had a remote-control turret in the tail with twin 0.50 calibre machine guns. Drop tanks as well as RATO bottles were planned to be carried under the wings as necessary. Production rates of up to 200 aircraft per month were envisioned in early 1945. As of April 1945, the plan was for the operational B-43 to have a canopy that somewhat melded the separate bug-eyes of the first XB-42 and the conventional canopy of the second XB-42; this unusual arrangement is shown in the diagram. In all likelihood, an operational B-43 probably would have had the conventional canopy of the second XB-42.

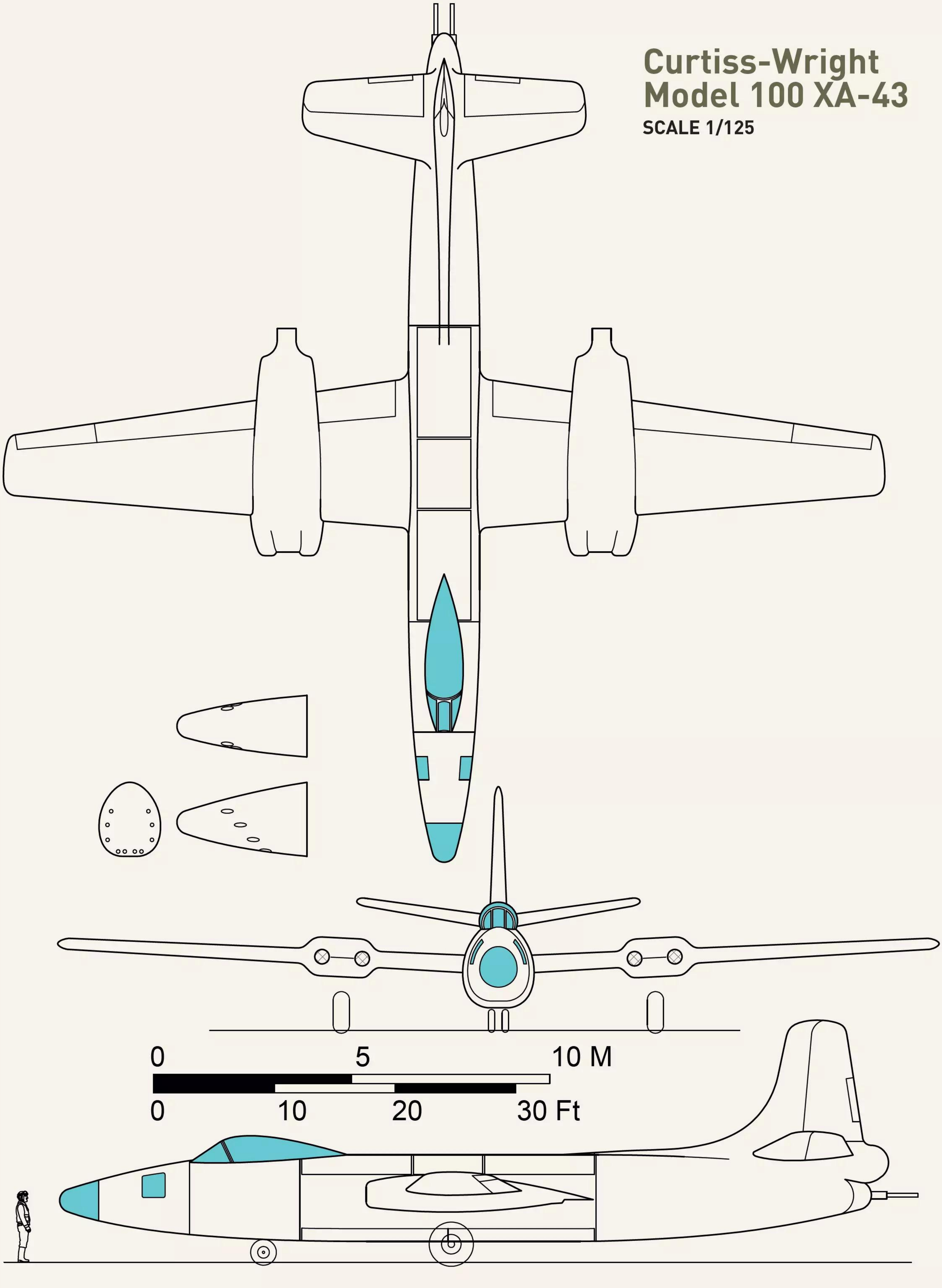
The first XB-43 finally flew on May 17, 1946, well after the war and just as jet technology was beginning to dominate. A second B-43 – the YB-43 – was built, flying a year later. The XB-43 ended its flying career in 1951, the YB-43 in December 1953. At one point Douglas had high hopes of a production contract, but other jet aircraft ended those dreams. By mid-1945, the North American B-45 and Convair B-46 bombers were just on the horizon… aircraft that had been designed from the ground up to be jet bombers. Production orders for pre-production and production B-47 bombers and attack aircraft were cancelled in July 1945.

Curtiss-Wright Model 100 XA-43

The Curtiss-Wright corporation tendered to the US Army a proposal for an attack bomber, Model 100, in October 1944. This was, for the time, a terribly conventional configuration… basically the same as the North American B-45 and the Boeing Model 413: a simple tubular fuselage, mid-set straight wings, a conventional tail and four Westinghouse 24-C turbojets in two somewhat rectangular nacelles, one mounted at about the 1/3 span position in each wing. Go-ahead to proceed with Model 100 came in November 1944, along with an official designation of XA-43.

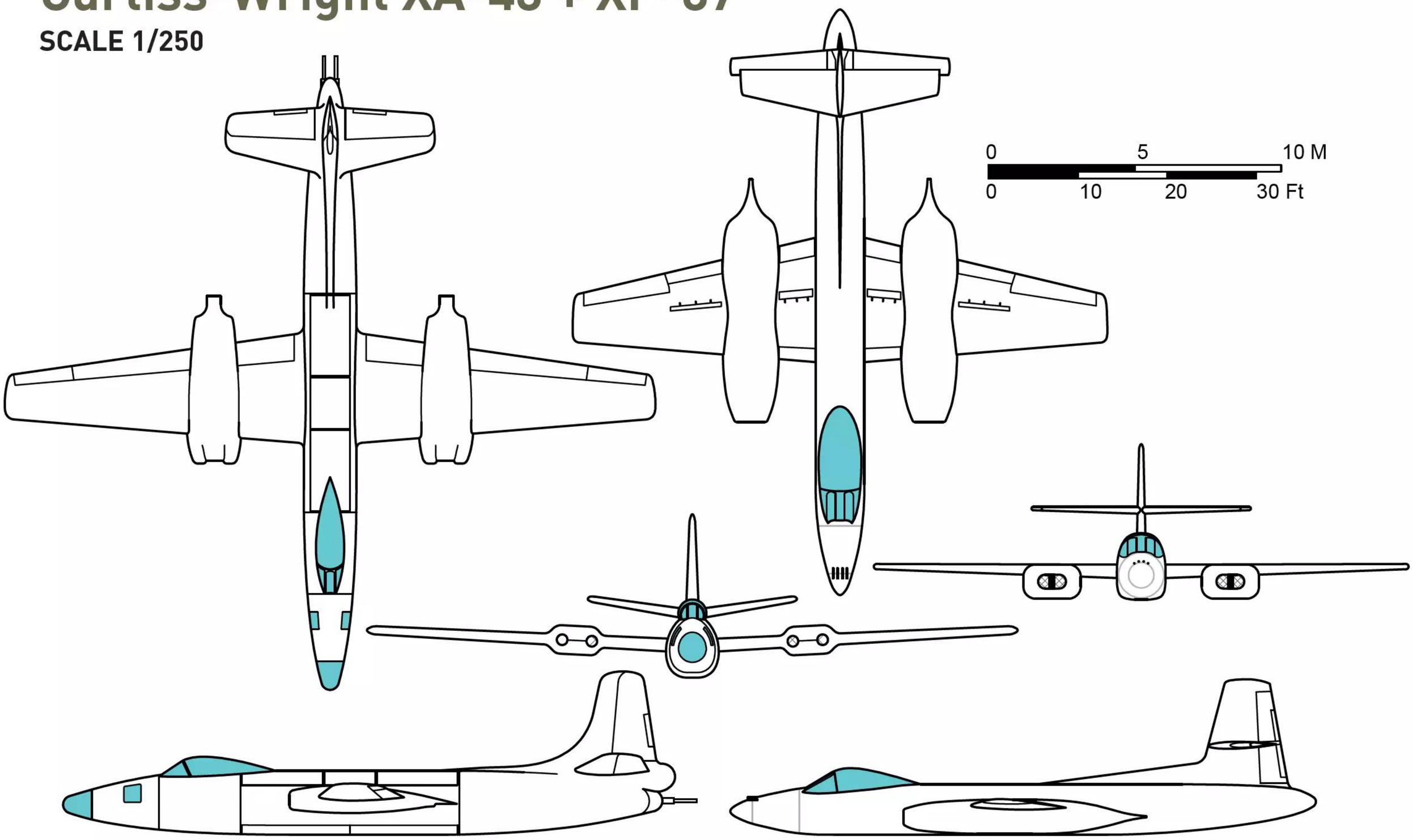
Curtiss-Wright Model 100 XA-43

SCALE 1/125



Curtiss-Wright XA-43 + XP-87

SCALE 1/250



The nose of the XA-43 was meant to be modular. Separate noses would contain different systems, allowing the aircraft to carry out different missions. These included:

1: Eight 20mm cannon
2: Six .60 calibre machine guns
3: Ten .50 calibre machine guns
4: One 75mm cannon and 2 .60 calibre machine guns
5: One 105mm cannon
6: Bombardier, plus two .50 calibre machine guns

All options were intended to have sufficient ammunition for 30 seconds of continuous fire.

The last option is illustrated here, and would be used to carry an additional crewman who would put bombs carried in the bomb bay reasonably accurately into the target. The bomb bay could contain up to 6,000lb of ordnance, with bombs ranging from 20lb to 2,000lb, or two Mk XIII torpedoes. A minimum of eight 5in diameter rockets could be carried under the wings. For defence, the plane was to be fitted with a remotely controlled tail turret with two .60 calibre machineguns with 300 rounds per gun. Alternatively, on a night fighter variant the turret could be replaced with a single Westinghouse 19XB2a jet engine. This would boost top speed from 611 to 630mph at sea level or 562 to 577mph at 30,000ft.

While a contract to build three prototypes was signed in late May 1945, the design soon fell short, both in predicted performance and when compared to revised requirements. The programme was cancelled in October that year.

The XA-43 did not proceed past the mockup stage. However, the design lived on, after a fashion, serving to a small degree as the basis of the XP-87 Blackhawk (begun in 1945). It is not true that the XP-87 was evolved directly from the XA-43; instead it was the direct result of an All Weather Fighter that the Curtiss-Wright Corporation designed in March 1945. However, the All Weather Fighter was a two-engined single seat aircraft that looked a great deal like the Gloster Meteor. The XP-87 that evolved from that was a large four-engined fighter laid out very much like the XA-43, the main distinguishing change being a somewhat stubbier wing. However, the XP-87 proved to be obsolete before it was first flown in March 1948. Designed as an all weather night interceptor, it lost to the Northrop F-89 Scorpion in late 1948. The XP-87 was the final aircraft built by the Curtiss-Wright Corporation.

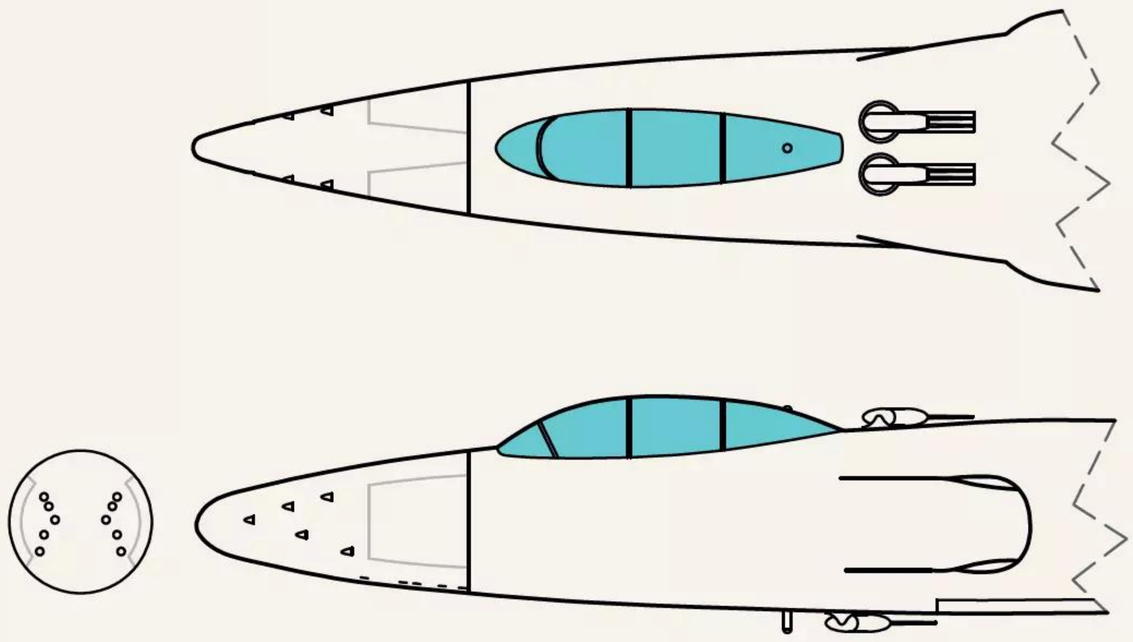
Convair XA-44

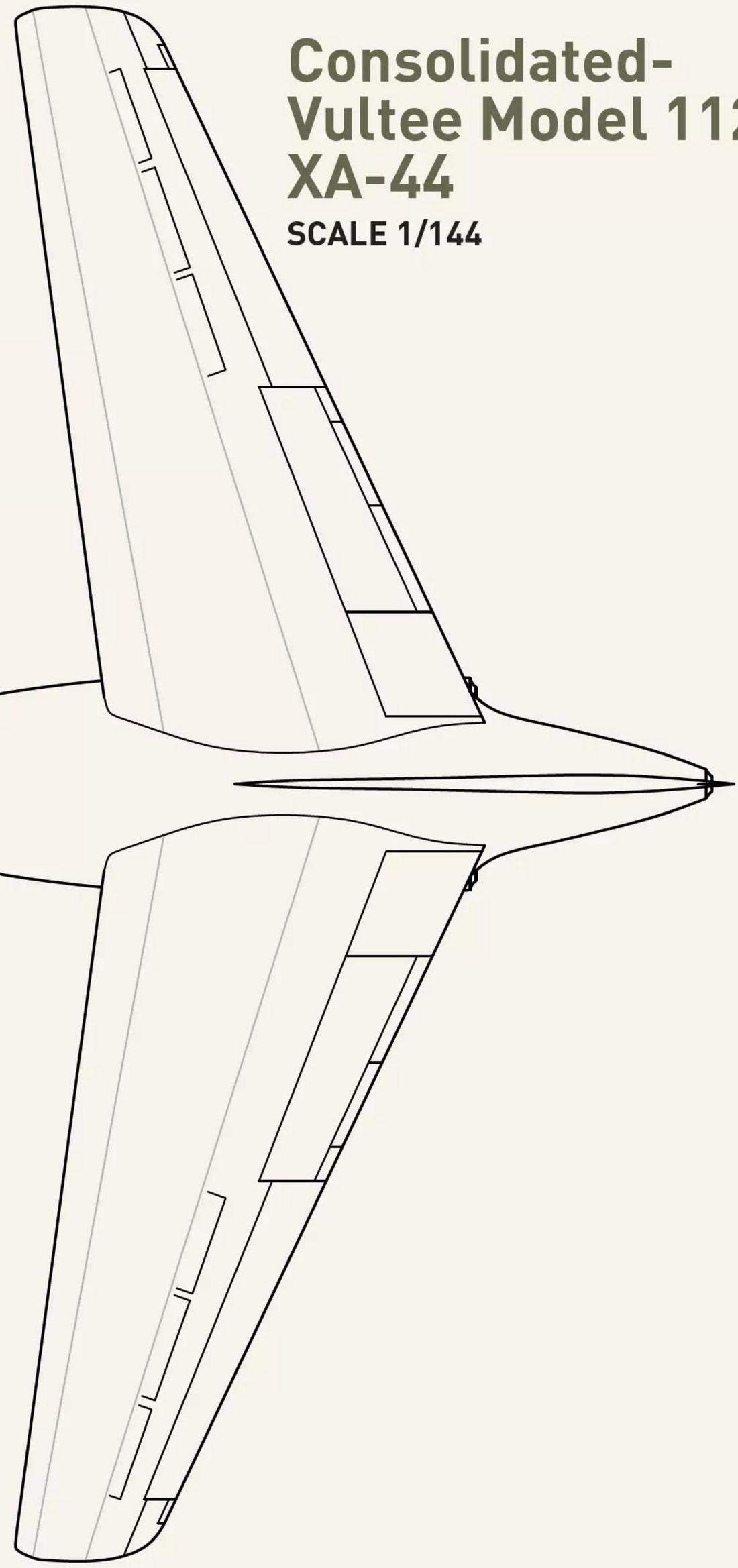
Almost certainly the most radical early American jet bomber concept was the Convair XA-44. This was a

Consolidated-Vultee Model 112 XA-44

SCALE 1/144

Escort Fighter Version





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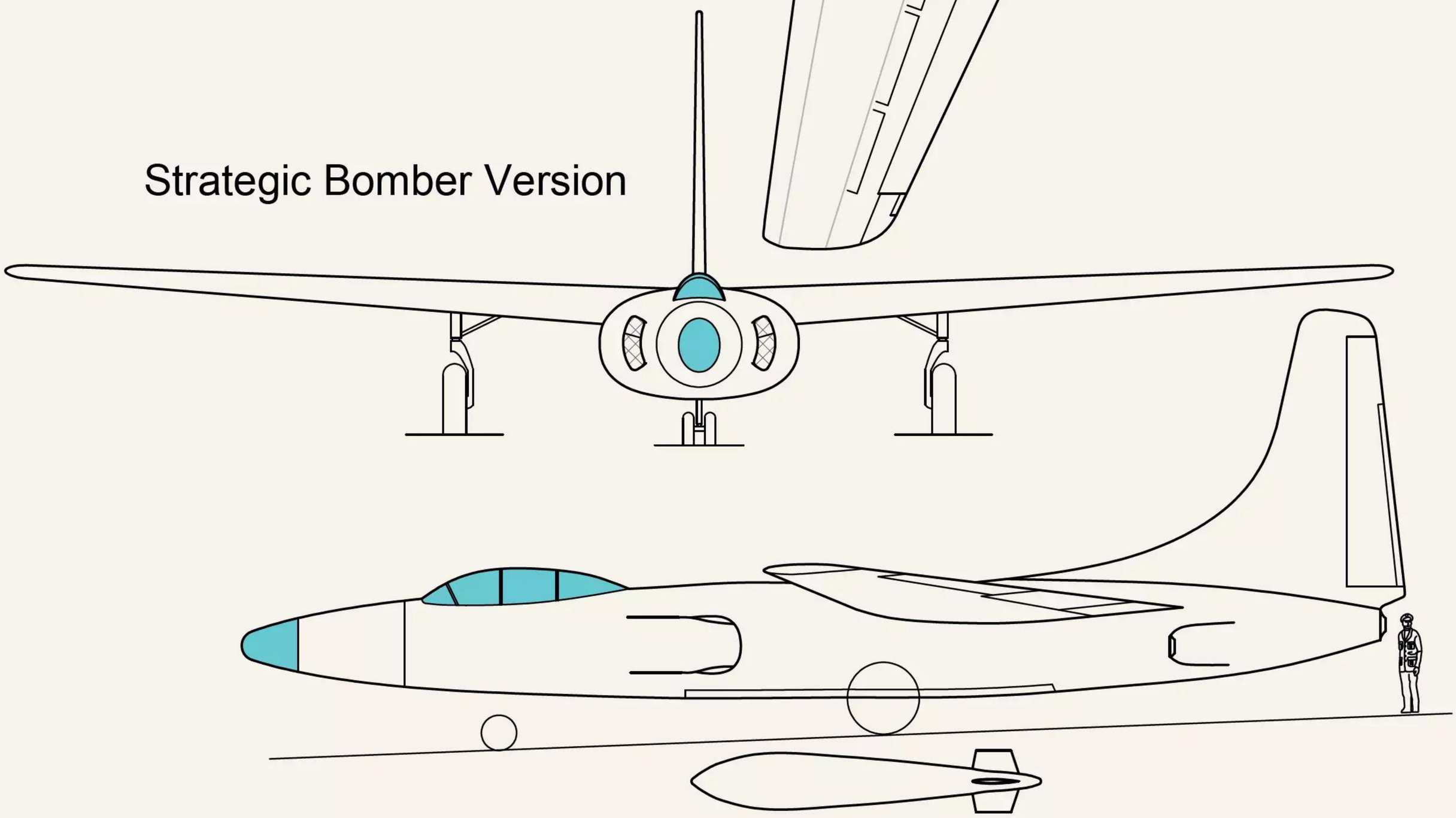
Strategic Bomber Version



12,000 lb TBM bomb

tailless design with three jet engines… and forward swept wings.

In July 1945 Convair submitted to the Army their proposal for the Model 112 attack bomber, primarily focused on ground-attack roles. As the Curtiss-Wright XA-43 and Douglas XB-43 showed, at the time straight wings were considered perfectly valid approaches to dealing with high speed. But Convair designers used modestly swept wings to alleviate the compressibility issues inherent in flying close to the speed of sound, perhaps inspired by preliminary reports coming in from captured German research. While the bulk of German research on the subject involved sweeping the wing back, Convair instead decided to sweep the wing forward 7.4° at the leading edge. Whether this decision was inspired by the German Junkers Ju 287 forward-swept jet bomber prototype is unknown. In any event, Convair's design used forward swept wings and neither tailplanes nor canards. This layout, at least theoretically, would permit low drag high-speed flight and low-speed, low drama/low angle of attack landing characteristics.

Three General Electric TG-180 axial-flow turbojets would be installed in the flattened fuselage, one on the centreline at the tail and one on either side of it, well ahead. 'Cheek' inlets fed air into the engines; the lower half of the inlets went straight into the side engines while the upper portions of the inlets were ducted together into the fuselage to feed the tail engine. The tail engine had short exhaust duct while the side engines had longer ducts angled slightly outboard. This arrangement would have been lower drag than putting the engines in external nacelles, at the expense of added complexity for maintenance and repair. Additionally, the flattened fuselage would, like the F-14 and F-15 some decades later, provide for some body lift, though it's unclear if that was an intent. Elements of the design, especially the nose and cockpit, bore similarity to the contemporary Convair XB-46.

The Convair Model 112 Attack Airplane was officially designated the XA-44 in December 1945. As with the Curtiss-Wright XA-43, the Convair XA-44 could be fitted with a multitude of noses with different armament options

1: Twelve .50 calibre machine guns
2: Eight .60 calibre machine guns
3: Eight 20mm cannon
4: One 75mm cannon and two .50 calibre machine guns
5: Photo and radar reconnaissance
6: Bombardier

Shown in the diagram is the dedicated strategic bomber variant, along with views of the nose of an escort fighter variant. The fighter would differ not only in having a dozen .50 calibre machine guns in the nose but also four retractable twin-.50 remotely controlled turrets, two above and two below the fuselage. The bomb bay would be fitted with additional fuel tanks. The strategic bomber variant, armed with a 'Tallboy' bomb, would have no guns. Attack bomber versions would have gun-armed noses, turrets and a bomb-laden bomb bay, but no dedicated bombardier.

The offensive load could be a single 12,000lb bomb, or 12 500lb bombs, ten 1,000lb bombs, two Mk XIII torpedoes and a 4,500lb bomb, or an internal rack containing up to 40 5in high velocity unguided rockets.

In April 1946 revised the design into a Light Bombardment Airplane by adding two additional crewmen and changing defensive armament to one dorsal and one ventral turret, each retractable with two 20mm cannon. Around that time more substantial design changes were incorporated; the wings, in response to ongoing wind tunnel testing, were swept more sharply forward. The inlets were changed from scoops to NACA-style flush inlets; the vertical stabilizer was modernized and swept back more, and a sizable 'blister' was added to the underside to house bomb-aiming radar. This resulted in a new design designated the 'XB-53'.

At this point Convair found itself in a contracting and competitive world. Costs for the unconventional XB-53 were going up at the same time they were buried deep in work on the XB-46. In January 1947 a termination order for the XB-53 was put in place, but the final end of the programme did not come until March 1951.

Aerodynamically, the XB-53 likely would have worked. But high speed and forward sweep are a combination with issues; the wingtips have an unfortunate tendency to try to twist upwards. Solving this would have required a very stiff wing structure, implying a heavy one. The advent of carbon composite structural materials made fast forward sweep possible, but as of yet no large aircraft has put forward sweep into practice.

North American B-45

The 1943 RFP for a fast jet recon plane, coupled with the arrival of German jet aircraft such as the Messerschmitt Me 262 jet fighter and Arado Ar 234 jet bomber and America's progress on jet fighter technology, led to the Material Division of the Army Air Forces in Washington, D.C. deciding that a jet propelled bomber was in order.

An October 1944 USAAF mission need statement for a jet bomber followed, with a November 1944 official RFP for a jet bomber. Boeing of course responded with their Model 432, but they were joined by North American Aviation, Consolidated-Vultee and Glenn L. Martin Aircraft, all receiving contracts in spring 1945. All of the responding companies produced designs that would, had they been powered by pistons engines and propellers, have been considered heavy bombers… but in this new

North American XB-45

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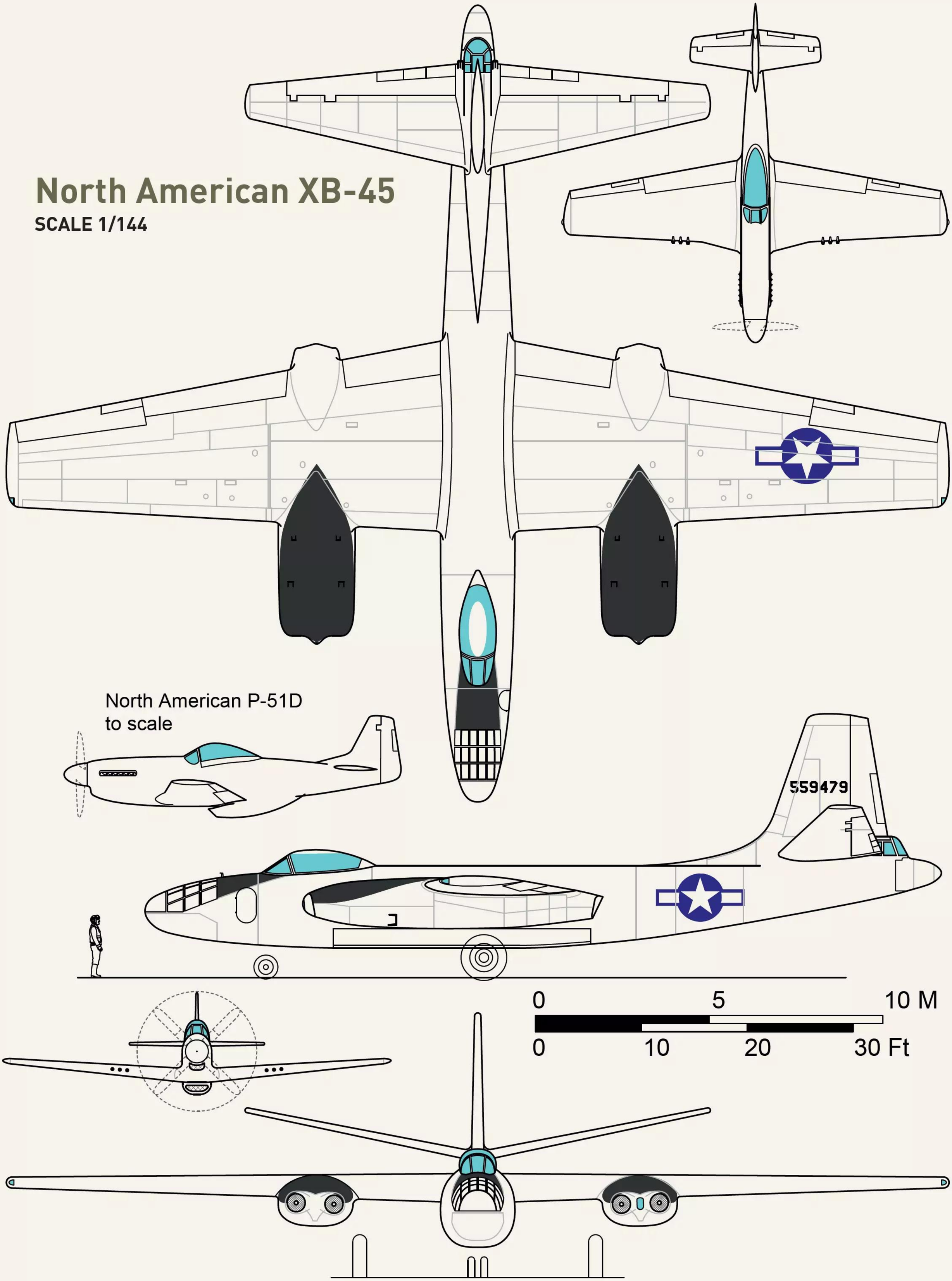
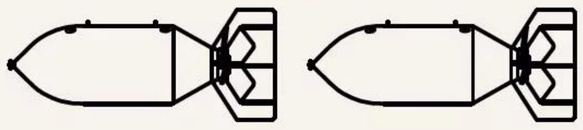


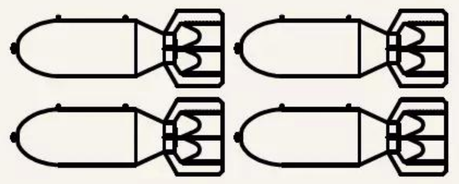
North American XB-45A

SCALE 1/144

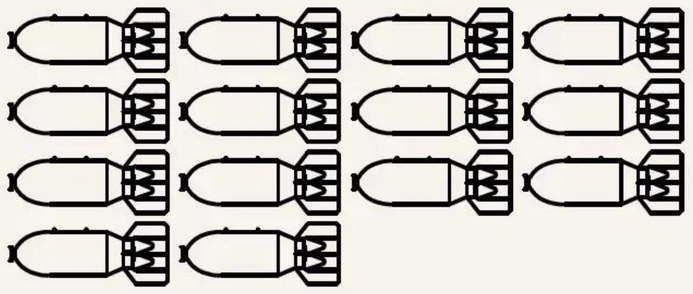
M56A1 4000 lb



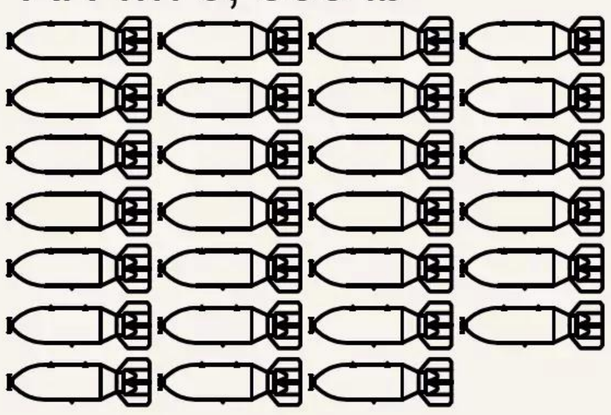
AN-M34, M66 2,000 lb

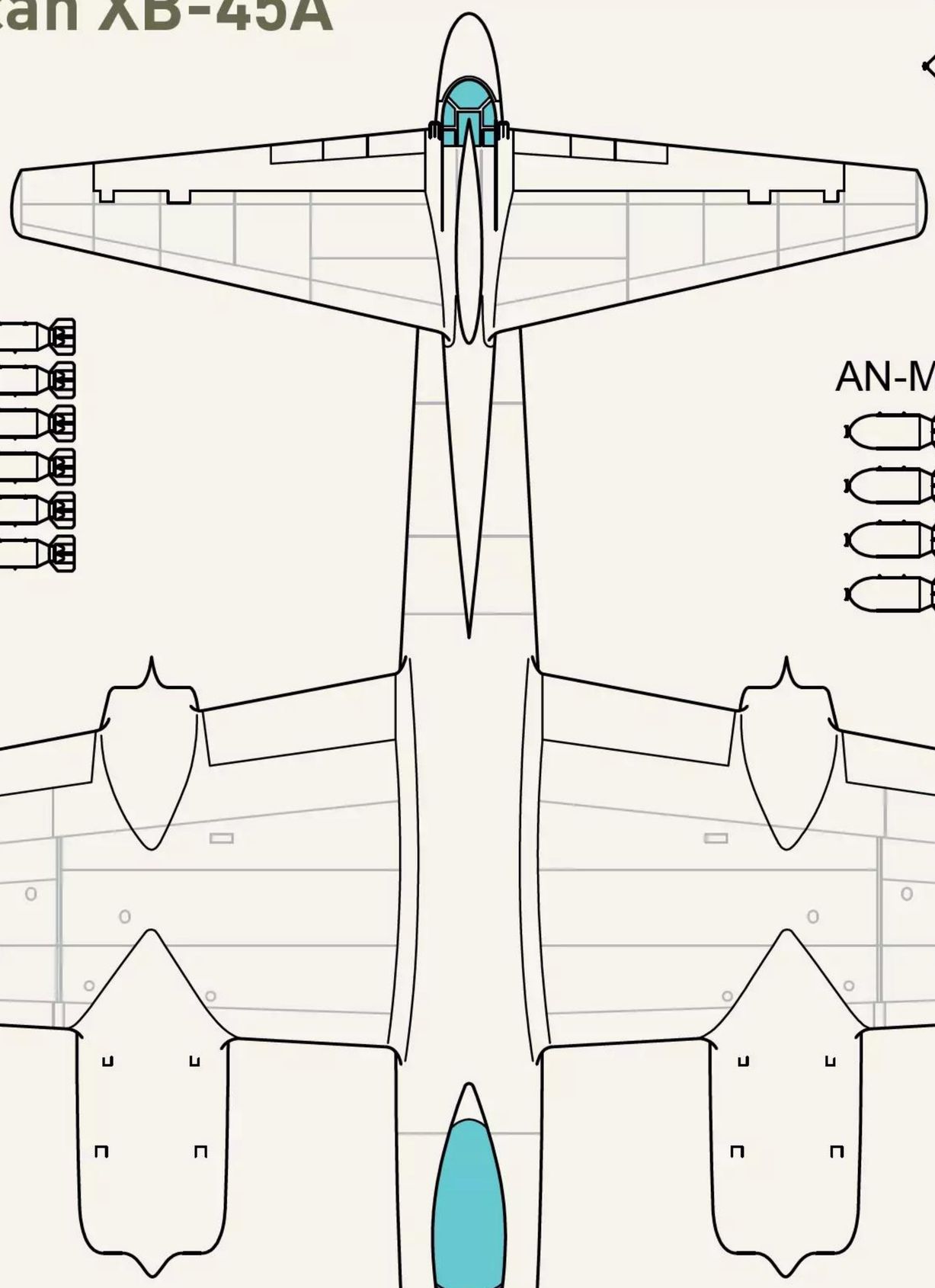


AN-M44, M65 1,000 lb

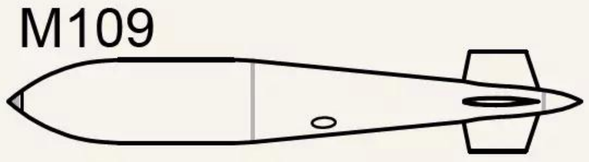


AN-M76, 500 lb





M109



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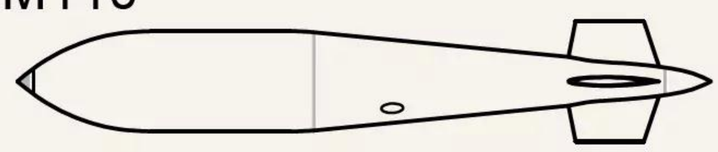

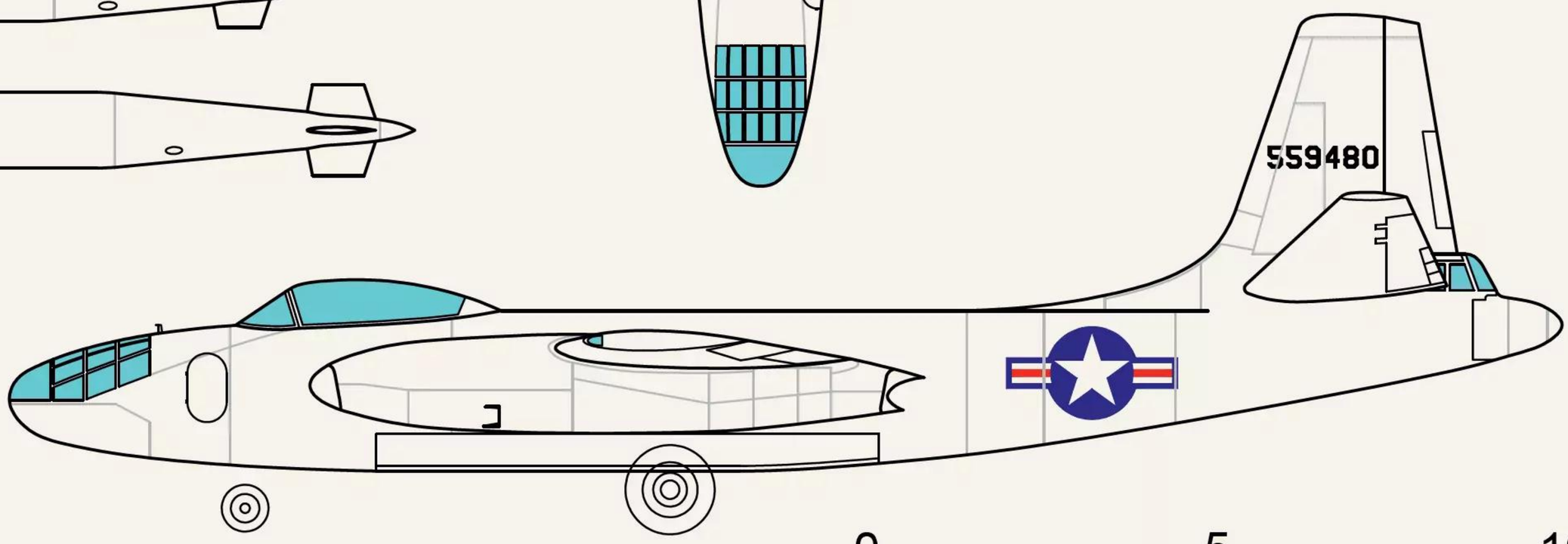

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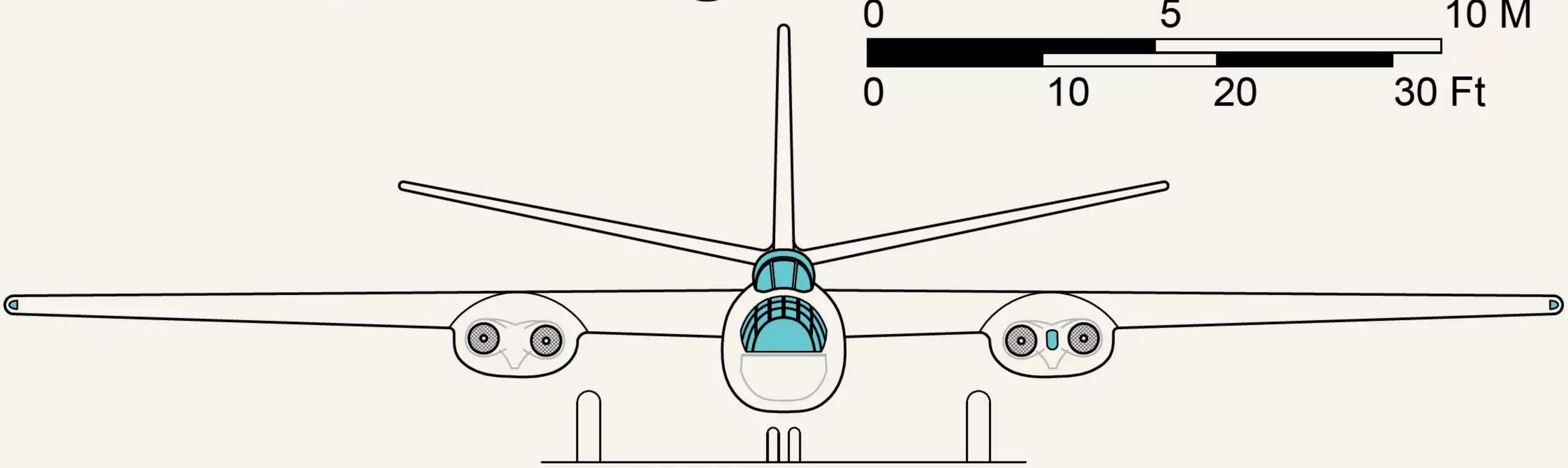


jet-age, they were all considered to be medium bombers. One desired feature of the new bomber was the ability to carry the 22,000lb 'Grand Slam' bomb; this has been taken by some to be a proxy for the then highly secret atomic bomb, but it is just as likely that he USAAF simply wanted a jet bomber that could actually carry the Grand Slam.

North American Aviation, builder of the venerable P-51 Mustang, knew a thing or two about high-speed aircraft so it was not surprising that their submission was given a production contract. Their design was broadly conservative and conventional, a straight-winged solid design with four TG-180 turbojets. The engines were in dual engine pods stuck directly to the undersides of the wings. The engines were located fairly far forward in the nacelles, just under the wing leading edge; long ducts took the exhaust to just aft of the trailing edge of the wing. The horizontal stabilizers were angled upwards with a dihedral of 12° in large part to get them out of the way of the jet exhaust.

Landing gear was of conventional tricycle type, the main wheels being of large diameter but relatively thin in order to store within the wings, inboard of the engines. All in all the design, granted the designation B-45 Tornado, looked very much like a late World War II American bomber, just with jet engines. It was a safe bet, and construction of three prototypes soon began. The first XB-45 flew in March 1947, demonstrating the successful nature of the design.

As with the P-51, the B-45 had laminar flow straight wings for low drag at relatively high speeds. In this case, high speed was initially a little over 500 miles per hour… a hundred miles per hour slower than the B-47, but faster than the near-contemporary P-51 Mustang. It was a definite advance over prior bombers in its class and it was safe and practical enough that the US Army Air Forces – or the United States Air Force, after September 1947 – put it into production and service. The B-45 saw service as a bomber in the Korean War, and was the first jet bomber shot down by a jet fighter.

Designed to carry WWII-era conventional bombs, it was modified to carry early nuclear weapons. To this end, on November 5, 1951, a B-45 dropped a 31 kiloton Mark 7 nuclear bomb over the Nevada test site during test 'Easy' of Operation Buster-Jangle, the first drop of a live nuclear weapon from a jet powered bomber. Modified into the RB-45C reconnaissance vehicle, the Tornado overflew China and the Soviet Union. The B-45C variant was the first jet bomber equipped for inflight refuelling, which greatly extended its range.

The North American B-45 had something of a twin: the Soviet Ilyushin Il-28. A jet bomber that first flew a year after the B-45, it had a remarkably similar configuration, with the biggest visual differences being the distinctly aft-swept stabilizing surfaces on the Il-28 and the Soviet plane having two large engines rather than four small ones. The biggest difference, though: the production run of the B-45 created 143 aircraft, while the Soviets stamped out more than 6,000 of theirs, the Chinese making a further 300. The B-45 ended its service days in the late 1950s (though a few test aircraft continued to fly into the 1970s), but the North Koreans continue to operate the Il-28.

Consolidated XB-46

Boeing's entry was seen as high risk but high reward, while the North American design was seen as safe and conservative. Consolidated Vultee and Martin, however, produced designs that were somewhat riskier than the North American concept but not as potentially promising as the Boeing design. Thus North American got early production contracts, Boeing was given time… and Consolidated Vultee and Martin were each given contracts for demonstrator aircraft.

Consolidated Vultee was at the time hardly unfamiliar with bombers. Their B-24 Liberator had been built in vast numbers; the under-development B-36 would be one of the largest aircraft to ever fly and would serve admirably in the post-war years. This gave them confidence that their design (Model 109, submitted in December 1944) would not only be a successful aircraft, but would win the contest. The initial contract called for three demonstrator aircraft, which Consolidated Vultee began work on following a successful mockup review in February 1945. But the contract was cut to just a single aircraft in late 1945; partly this was due to a general slowdown in military development contract at the end of the war, but it was also due to a planned diversion of the XB-46 funds to help fund the development of another Convair (as Consolidated Vultee was increasingly referred to) project, the XA-44.

Consolidated Vultee's entry was remarkably similar to the original Boeing Model 413 in configuration. But for all their comparable attributes, the Consolidated design was unarguably one of the most graceful and handsome aircraft ever to grace the skies. As with the Model 413 and even the B-45, the layout of the XB-46 was conventional: a tubular fuselage with straight shoulder-mounted wings, a dual-engine nacelle directly below each wing, a conventional tail unit. But Convair made every effort to make their aircraft as sleek and aerodynamic as possible. The fuselage was long and gradually tapering at both ends; the wings were clean and relatively high aspect ratio. The result was an aircraft with a remarkable resemblance to a high-performance sailplane; reportedly, if the aircraft lost power at 40,000ft it could glide 200 miles. For flight at low speed the wings sported Fowler flaps that extended across 90% of the span. The engine nacelles were rounded pods containing two engines each,

M56A1 4000 lb

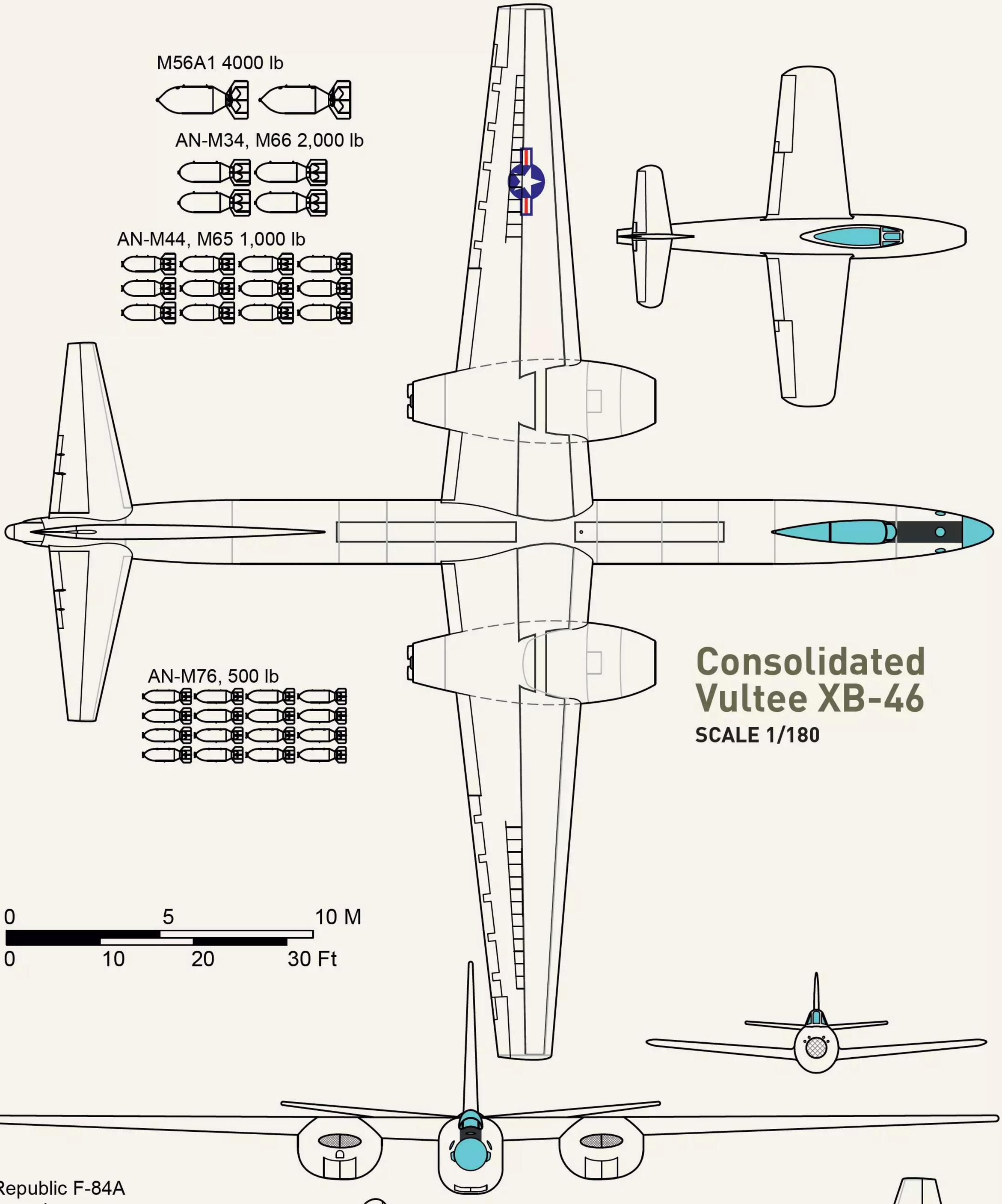
AN-M34, M66 2,000 lb

AN-M44, M65 1,000 lb

AN-M76, 500 lb

0 5 10 M

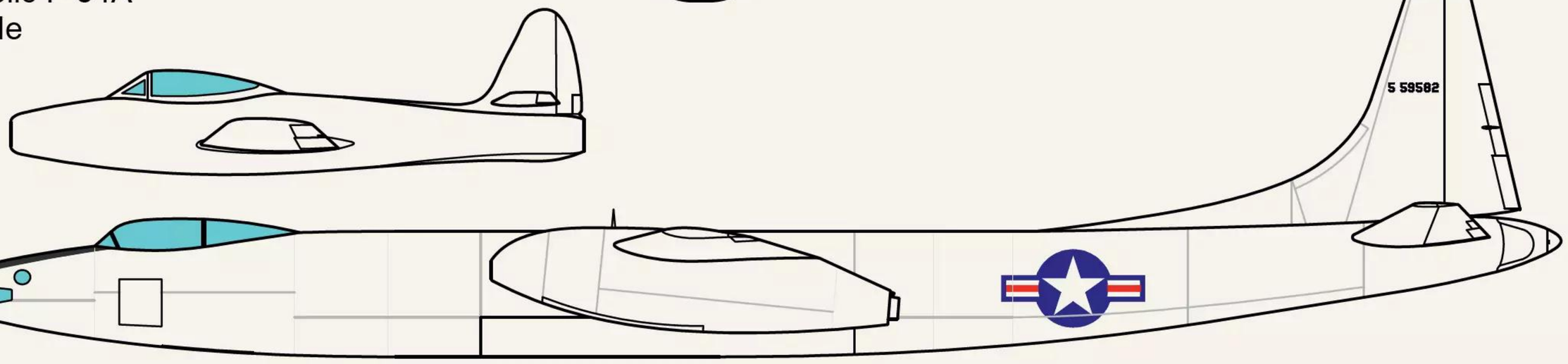
0 10 20 30 Ft



Consolidated Vultee XB-46

SCALE 1/180

Republic F-84A
to scale



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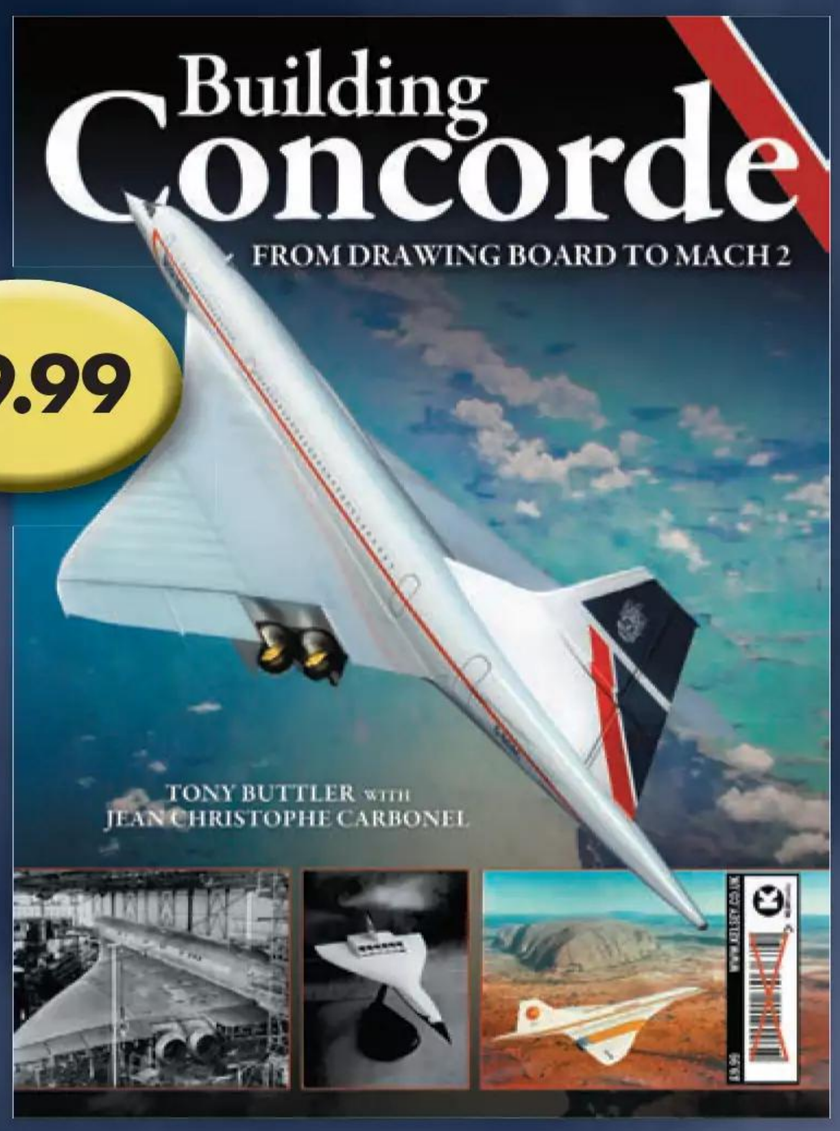

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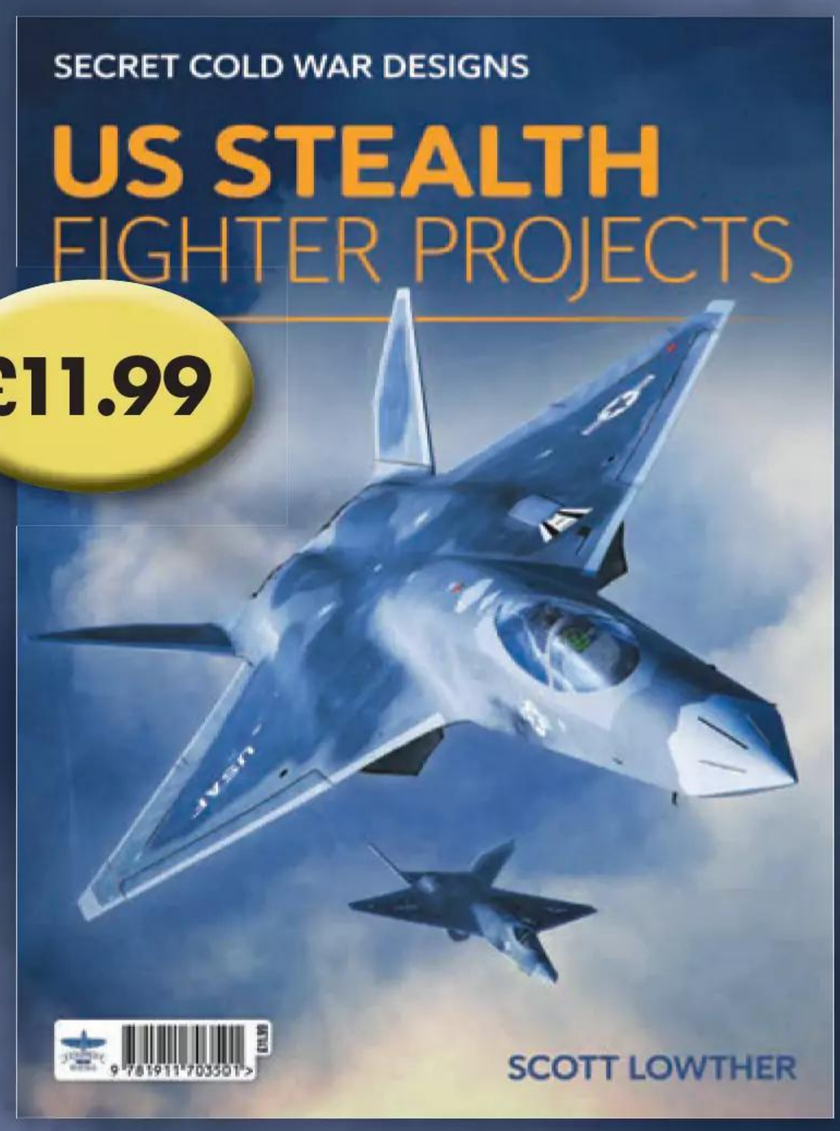

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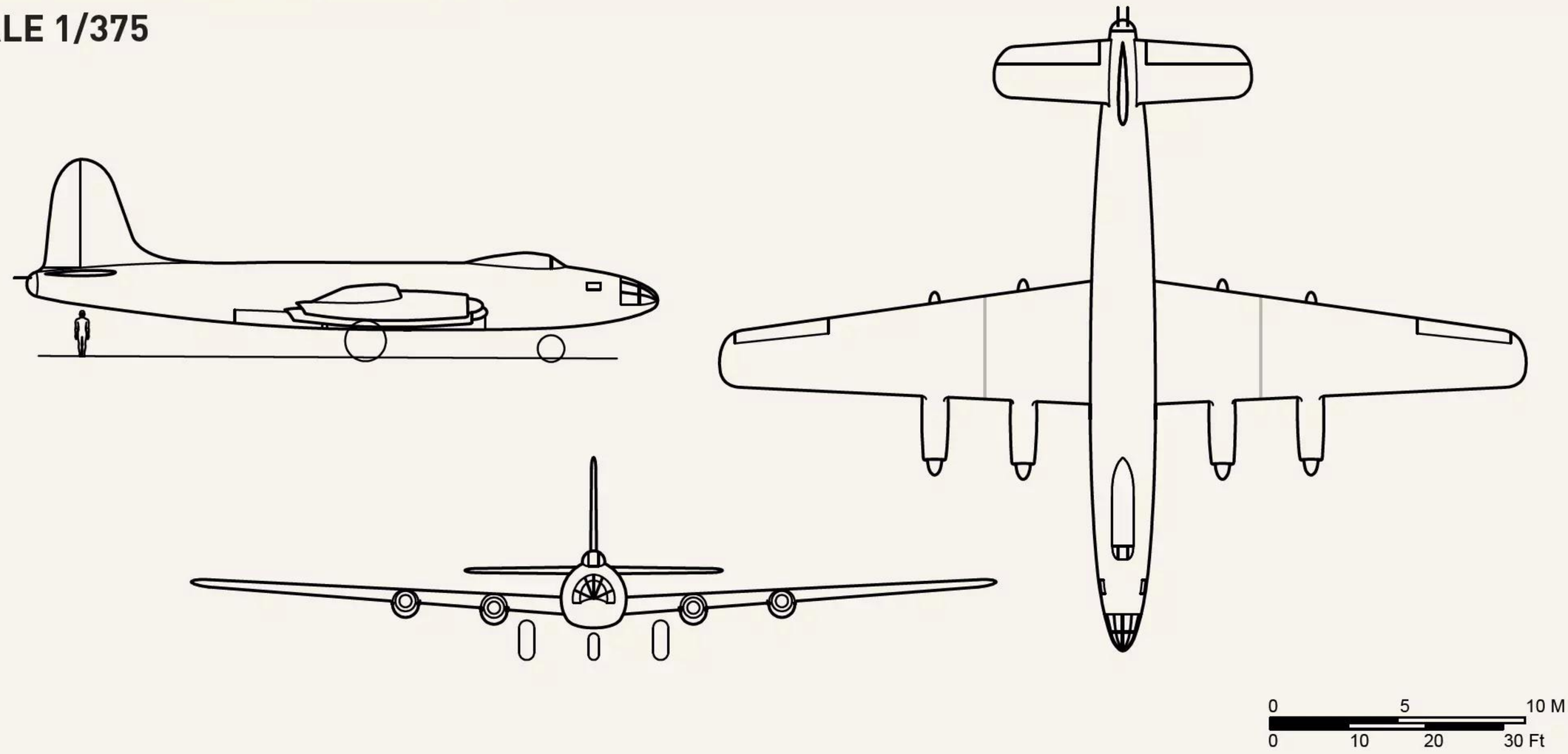
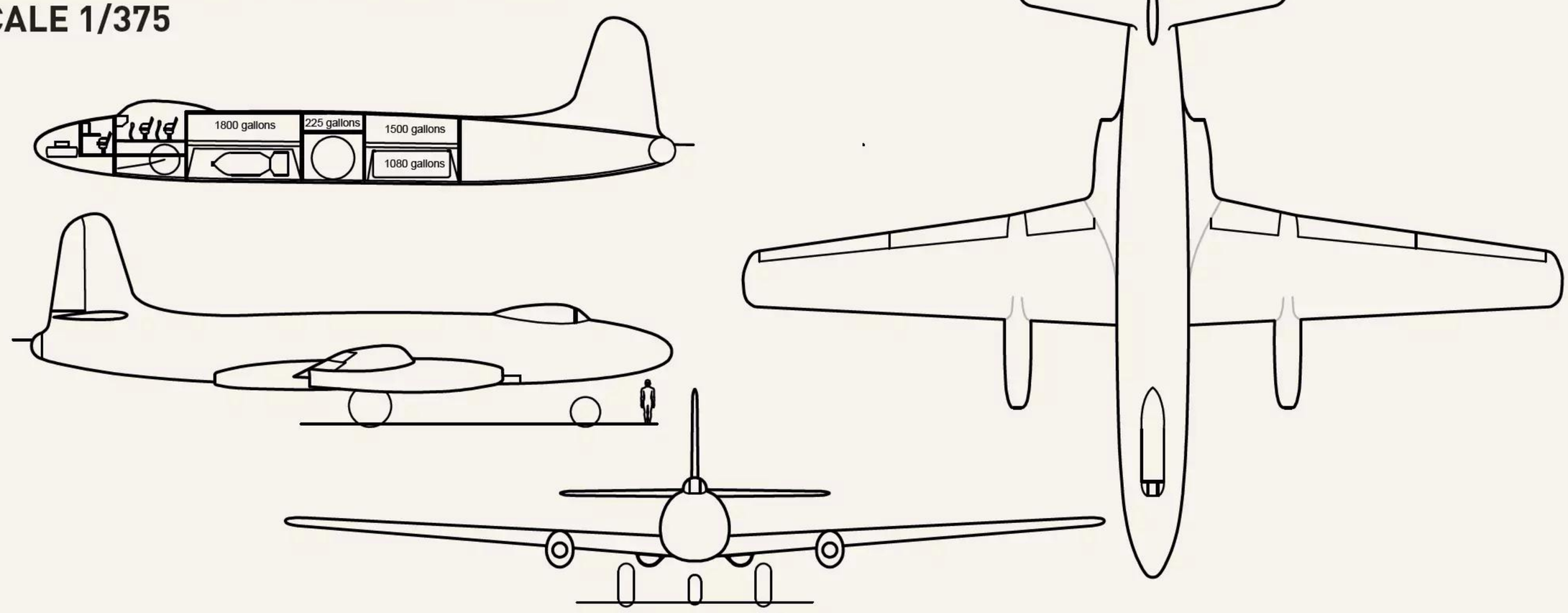
Martin Model 223-1

SCALE 1/375



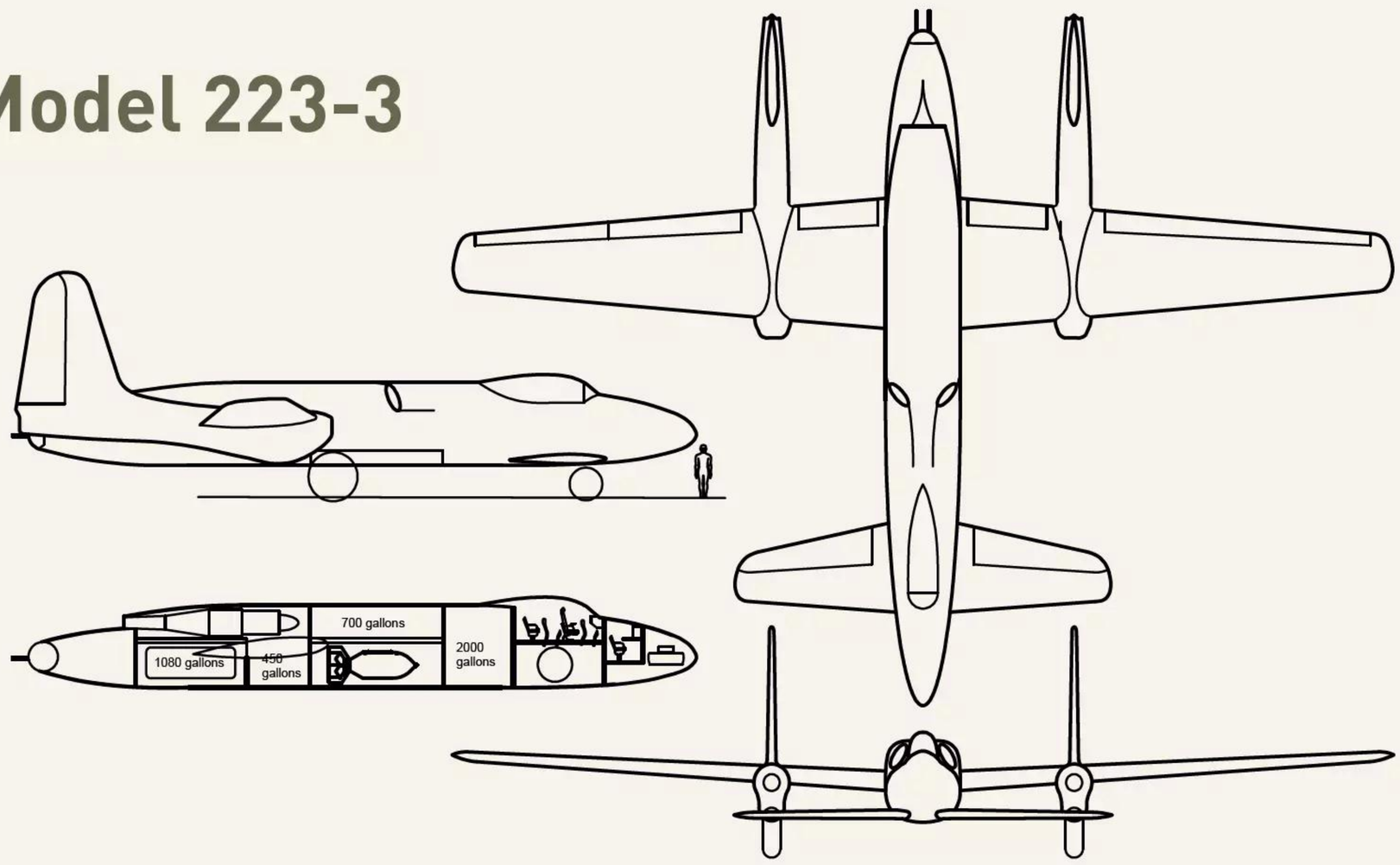
Martin Model 223-2

SCALE 1/375



Martin Model 223-3

SCALE 1/375



fed from a single oval inlet; the inlet duct bifurcated, splitting around the main landing gear bay. The engines exhausted from separate nozzles at the tapered rear of the nacelles, just aft of the trailing edge of the wing.

The XB-46 was designed to be all-pneumatic, with no hydraulic or electric actuators for mechanical systems. The engines that Convair wanted for the plane, General Electric J47s, were not available for the prototype and they had to settle for Allison J35s resulting in a substantial reduction in maximum thrust. The operational B-46 would have had a remotely operated tail turret equipped with two .50 calibre machine guns; there were proposals to mount four fixed 20mm cannon or a twin-.50 turret in the nose. What exactly a sizable bomber like the -46 would do with four cannon fixed forward in the nose is anyone's guess; it seems unlikely that it would be used for dogfighting and it seems a little large for low altitude ground-attack.

The XB-46 was a large aircraft with a span of 113ft and a length of 105ft 9in. It did not have the B-29's 141ft wingspan but it exceeded the B-29's length of 99ft. It was substantially lighter than the B-29, both in terms of gross weight and payload, and had a shorter range. However, it could fly nearly two hundred miles per hour faster than the B-29.

The single XB-46 flew for the first time in April 1947. It flew well and was liked by its pilots, though it did have a number of problems with oscillation and a list of mechanical and electrical issues. But even though, on the whole, the test flights were promising it was up against the B-47, and the XB-46 flew for the last time in 1950. It was unfortunately scrapped.

It is interesting to imagine what might have been produced had the designers of the XB-46 incorporated swept wings. Such an aircraft would likely have posed a serious challenge to the XB-47, and likely would have looked damned good while doing it. Unfortunately, this author is unaware of any such design work. The XB-46 seems to have been firmly rooted in straight wings.

Martin XB-48

Martin's submission to the November 1944 RFP for a jet bomber resulted in a contract for the XB-48. Fortunately, the design evolution of the XB-48 is somewhat well documented. 'Well documented' in that good diagrams are available for a dozen designs; 'somewhat' because the diagrams are, at least as far as this author has seen, all that has come to light. The earliest direct ancestor of the B-48 was the Model 223-1, dating from October 1944, a result of prior Army medium bomber requirements.

Model 223-1 was a straight/mid-winged bomber with four TC-180 turboprop engines. It was conventionally configured; were it not for the turboprop engines it would have looked like a quite stereotypical early-war era heavy bomber design. It was equipped with two bomb bays, one ahead of the wing spar, one aft. The total bomb load was sixteen 500lb bombs, eight bombs in each bay. A remotely controlled ball turret in the tail provided for self-defence. Crew appears to have been three... pilot, copilot and bombardier under a high glazed nose.

The next iteration, Model 223-2, was a straight/low-winged bomber with four undefined (though probably GE TG-180) turbojet engines. The aircraft was much like that of the 223-1, except the wings were moved lower. One jet engine was located in front of and just below the main wing at about 1/3 span. One jet engine was located aft of and just below each trailing wing root, alongside the fuselage. It was equipped with two bomb bays, one ahead of the wing spar, one aft. The forward bomb bay could hold fourteen 500lb bombs, or eight 1,000lb bombs, or two 2,000lb bombs or a single 4,000lb bomb. The aft bay could hold the same except for only four 1,000lb bombs. The aft bomb bay could also be fitted with a 1,080 gallon fuel tank instead of bombs. Otherwise, the plane held 4,525 gallons of fuel. There was a remotely controlled ball turret in the tail for defence.

Again, there were three crew: pilot, copilot and bombardier. Unlike Model 223-1, the –2 did not have a transparent nose with optical bomb aiming (as was common during WWII). Instead, it had a radar system in there, with the bombardier behind it.

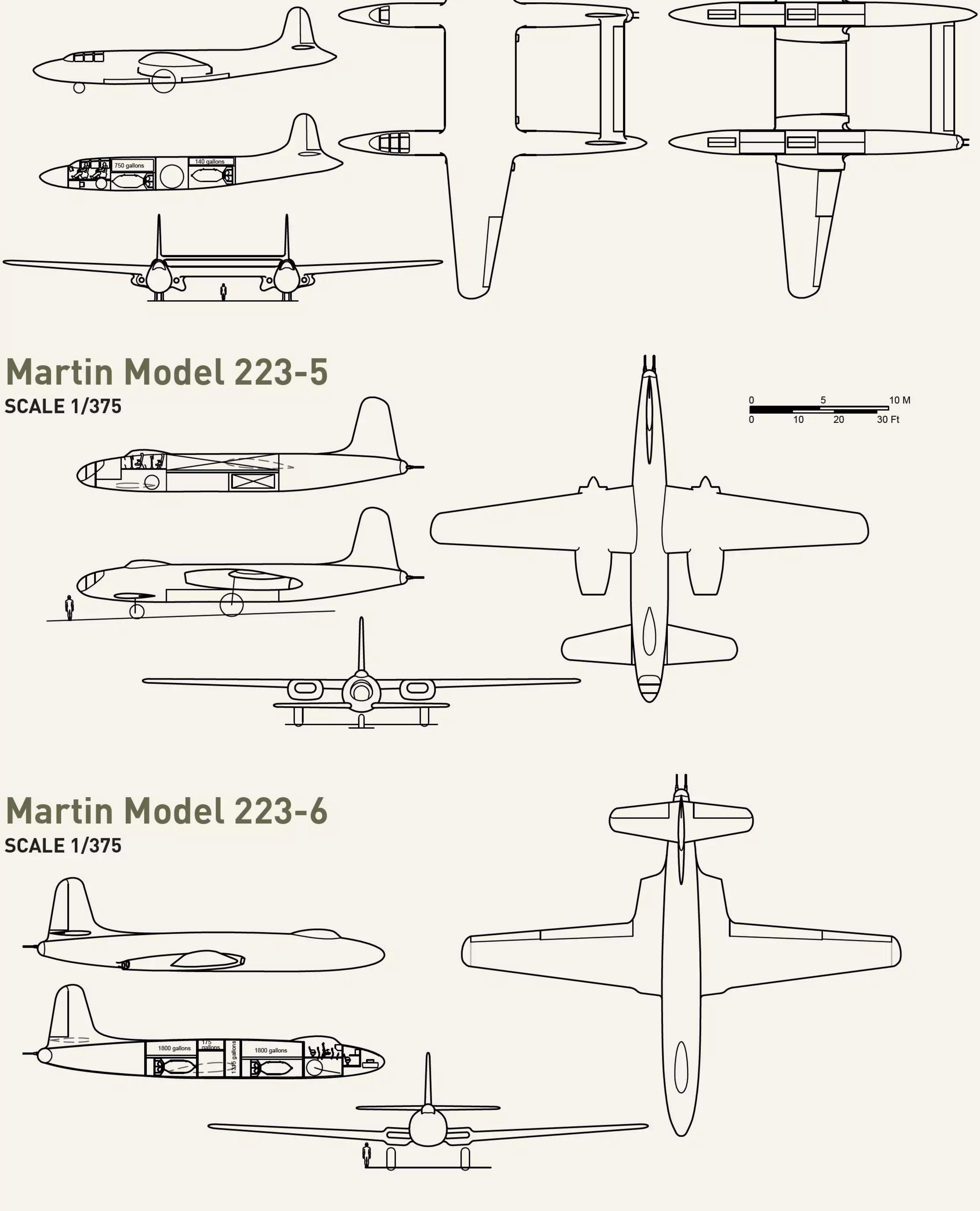
Model 223-3 was unconventionally configured, with canards and unconnected tail booms. The Model 223-3 configuration was very similar to that of the earlier Model 189 Design #4 from March 1941, which was a canard version of the Martin B-26. The central fuselage of the 223-3 had two turbojet engines in the upper rear fuselage, fed from separate shoulder mounted inlets. It was equipped with two bomb bays, one ahead of the wing spar, one aft. The total bomb load for the forward bomb bay could be composed of fourteen 500lb bombs, eight 1,000lb bombs, two 2,000lb bombs or one 4,000lb bomb; the aft bomb bay could carry fourteen 500lb bombs, four 1,000lb bombs, two 2,000lb bombs or one 4,000lb bomb; alternatively a 1,080 gallon fuel tank could be installed. Once again, there was a remotely controlled ball turret in the tail. And again, the crew of three included the pilot, copilot and the radar-operating bombardier.

Each tail boom contained a single turbojet engine as well as a single main landing wheel. The location of the wheel would seem to have made the inlet ducting issue rather complex.

Model 223-4 used no design elements of the prior versions and was the most unusual of the series, with two separate fuselages separated by a central straight wing section. Each fuselage had a fore and aft bomb bay, each capable of holding a 4,000lb bomb. The port fuselage had a crew of two; the starboard only one. The remotely

Martin Model 223-4

SCALE 1/375



Martin Model 223-5

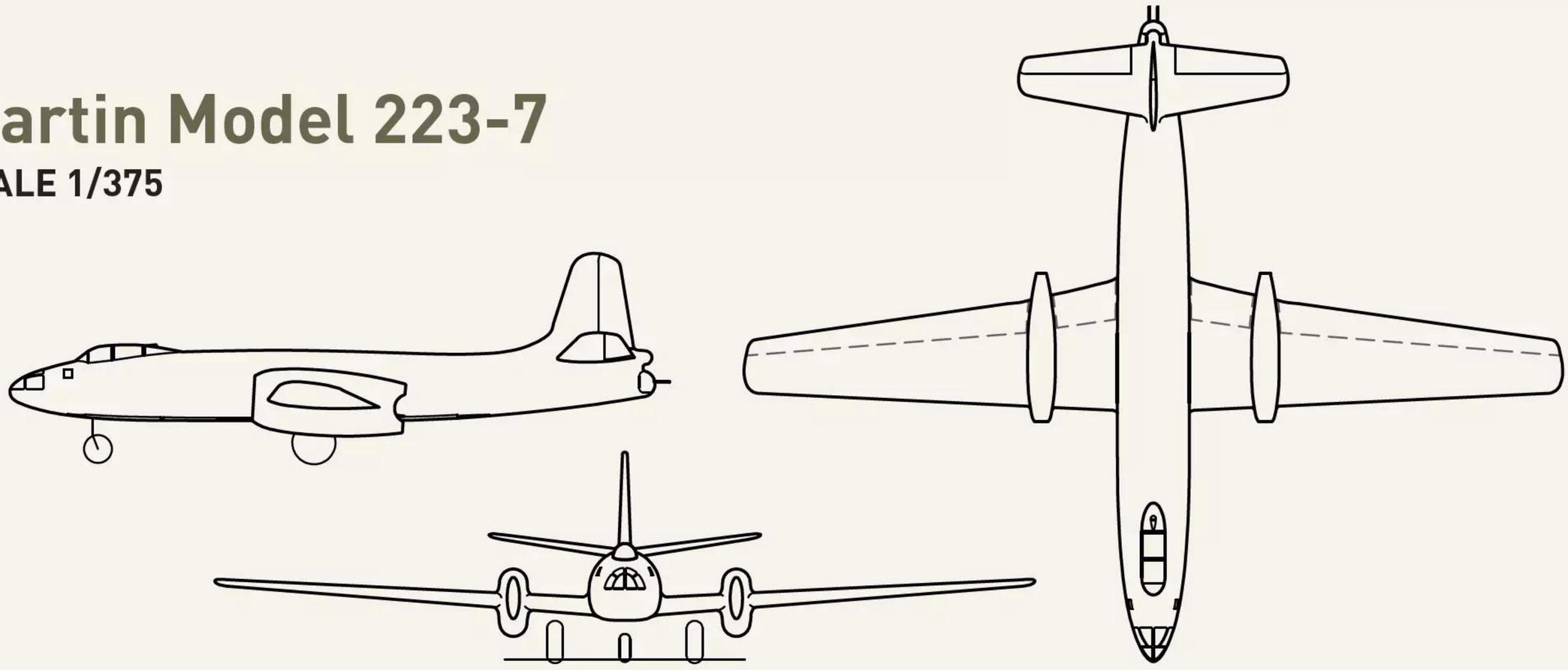
SCALE 1/375

Martin Model 223-6

SCALE 1/375

Martin Model 223-7

SCALE 1/375



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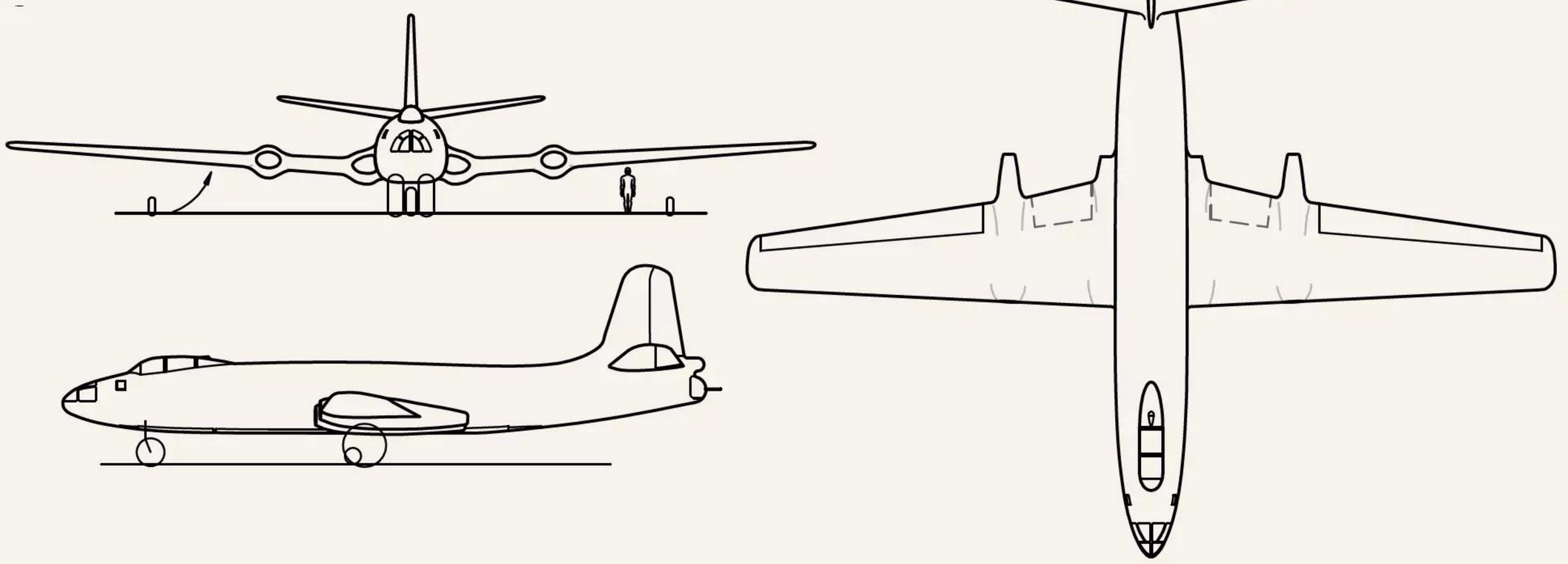
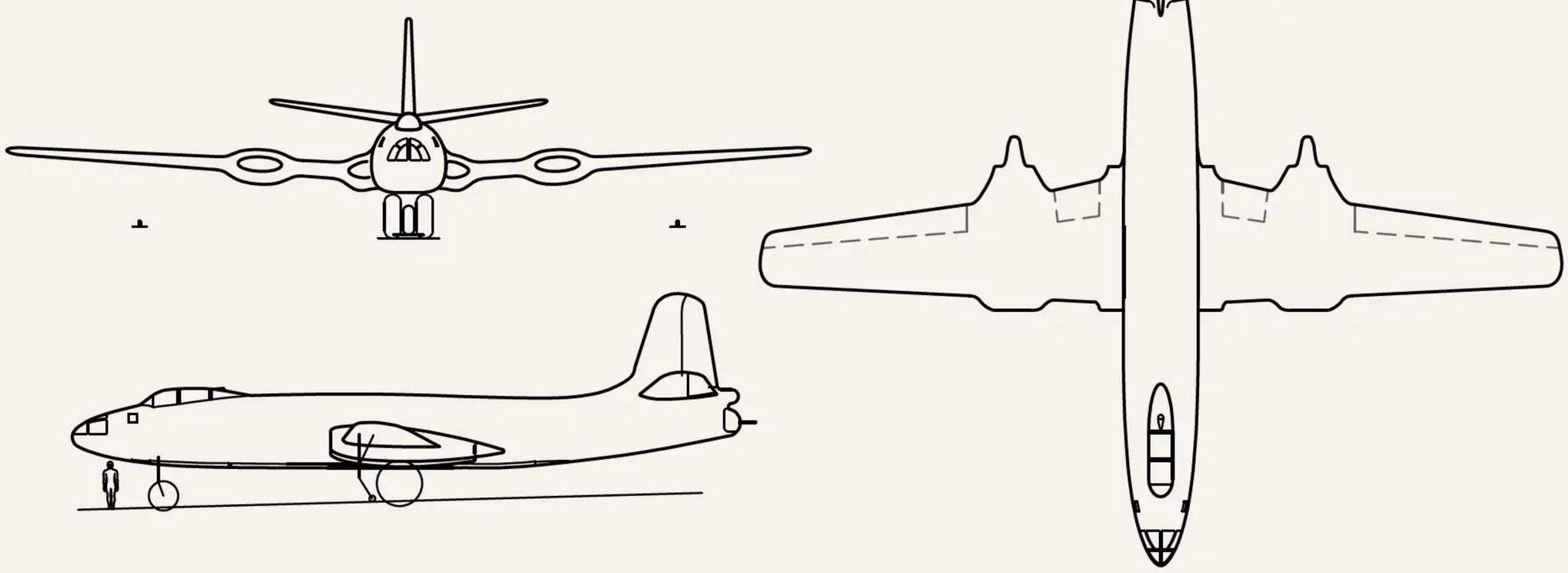
Martin Model 223-8

SCALE 1/375



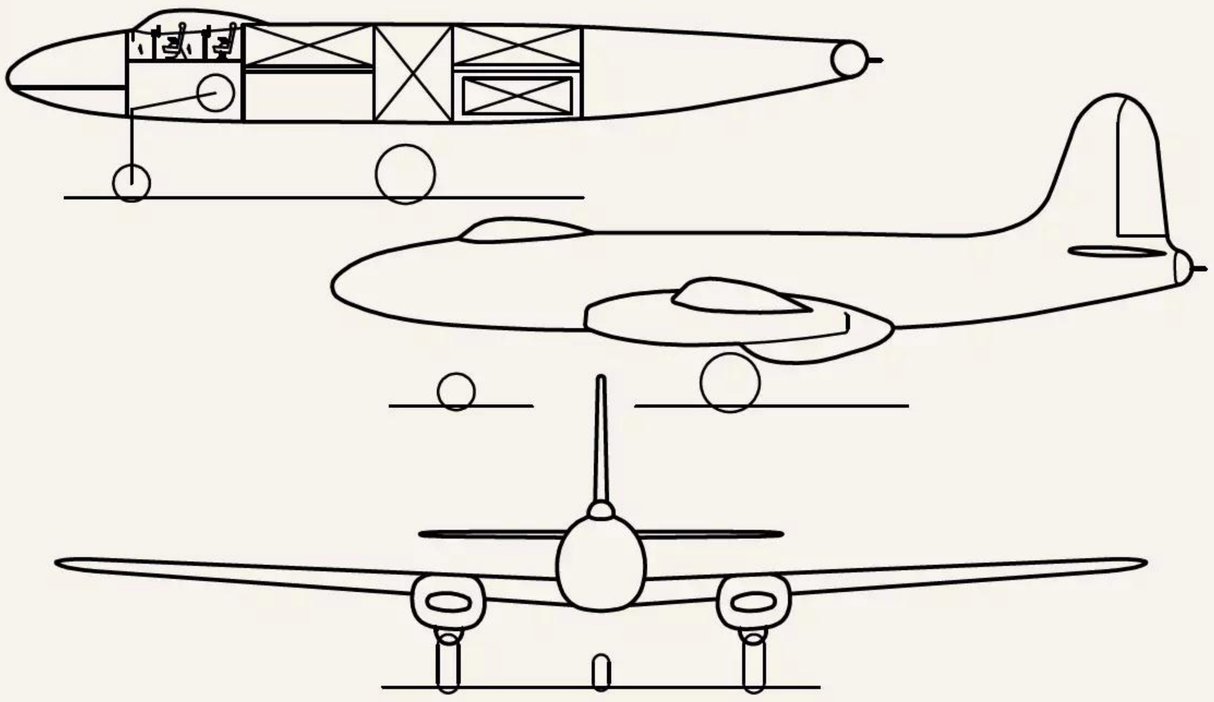
Martin Model 223-9

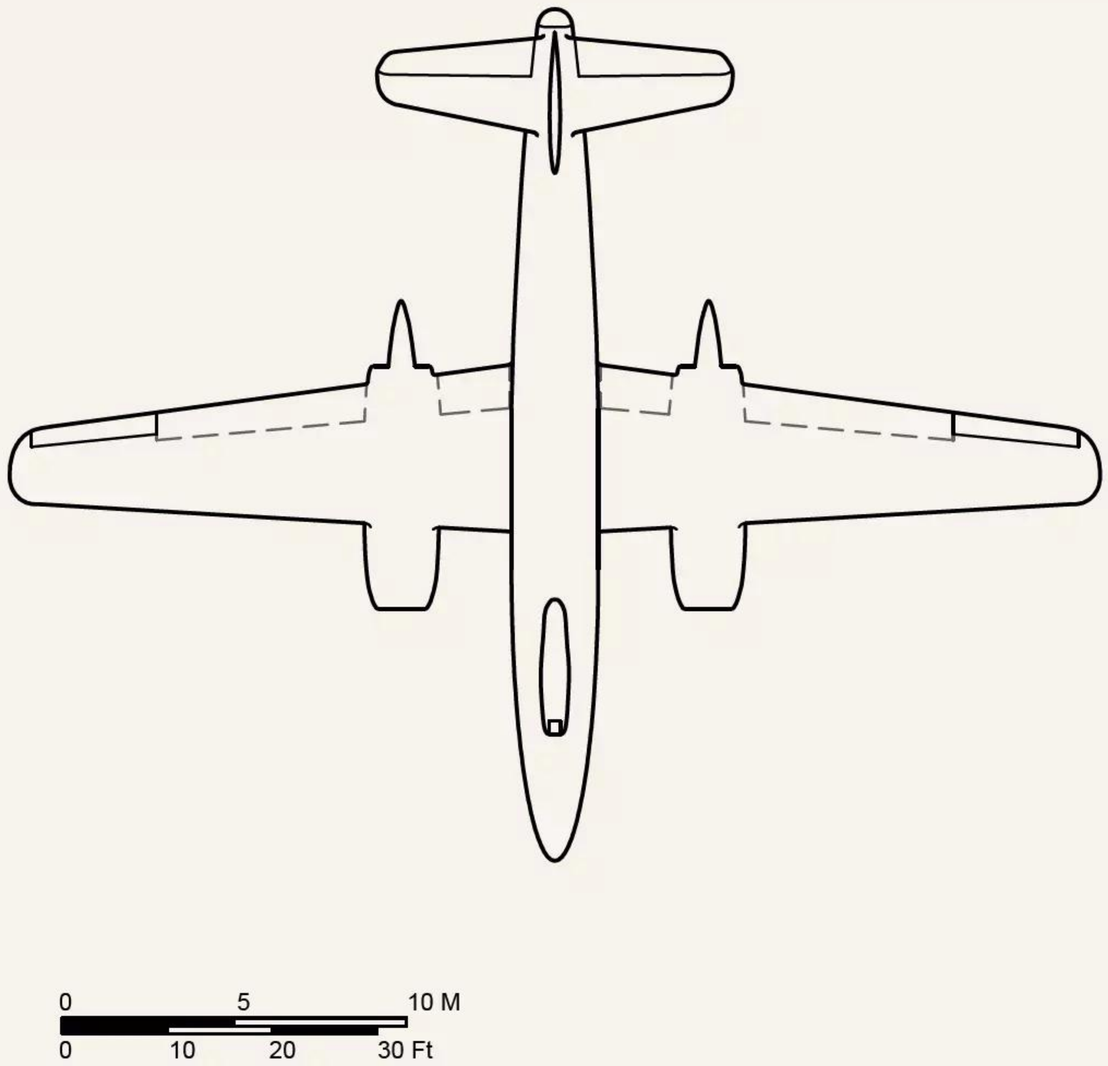
SCALE 1/375



Martin Model 223-10

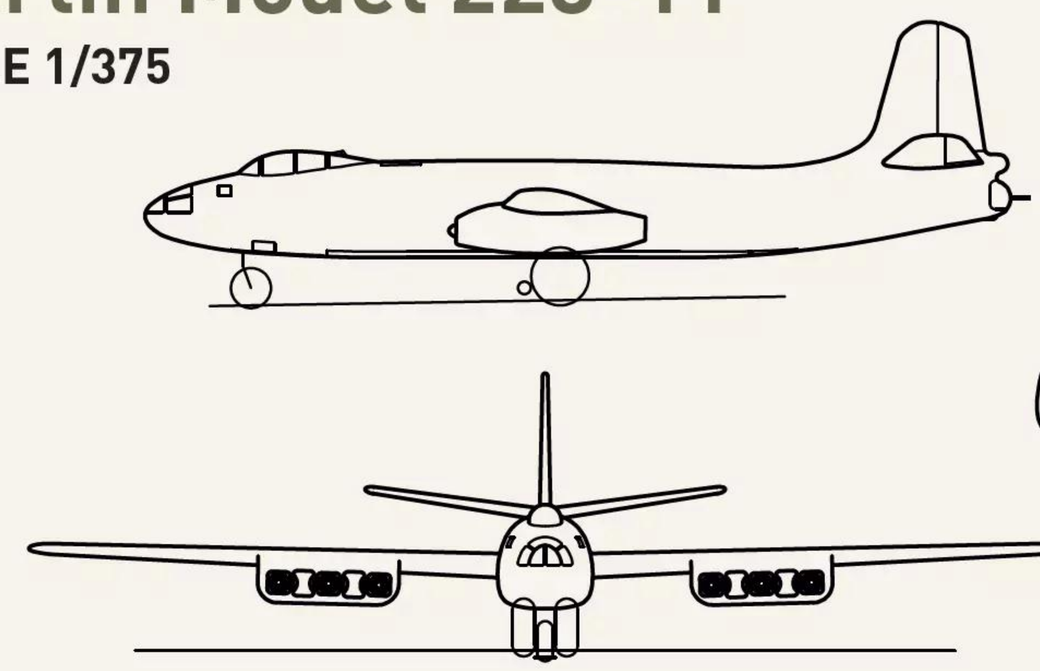
SCALE 1/375

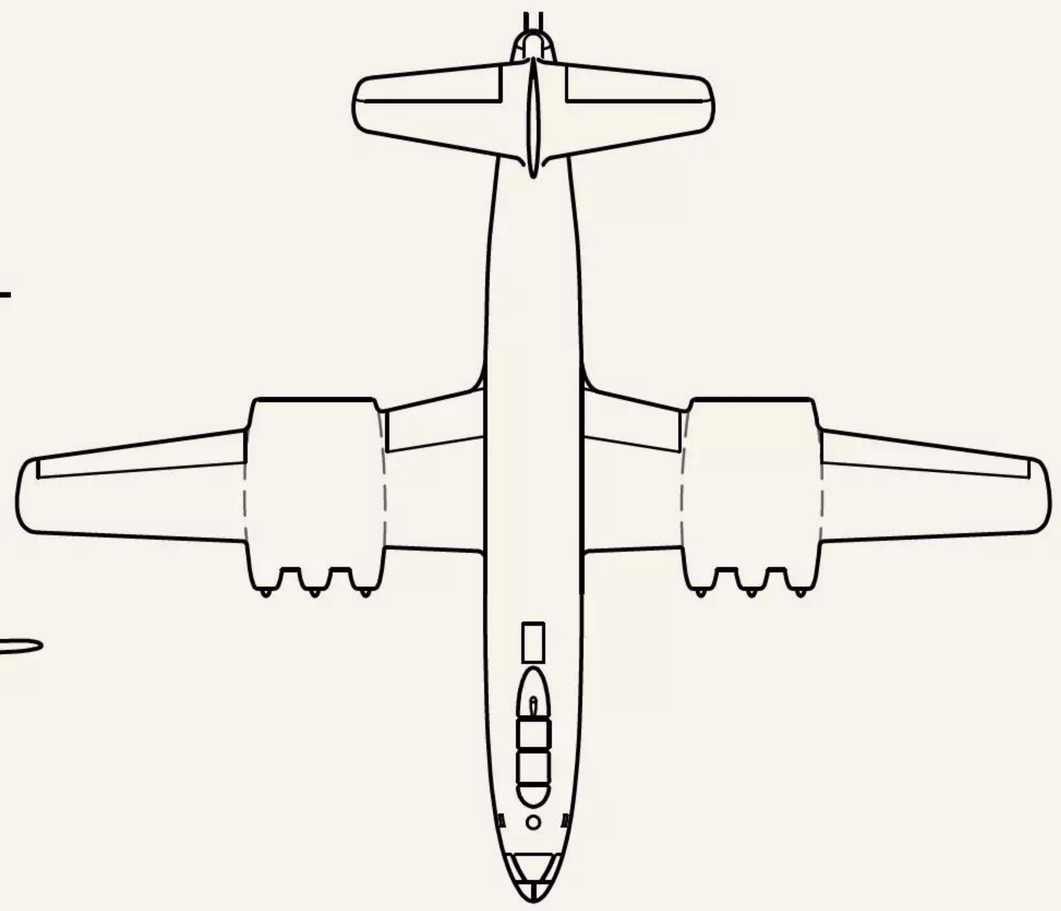




Martin Model 223-11

SCALE 1/375





Martin Model 223-12

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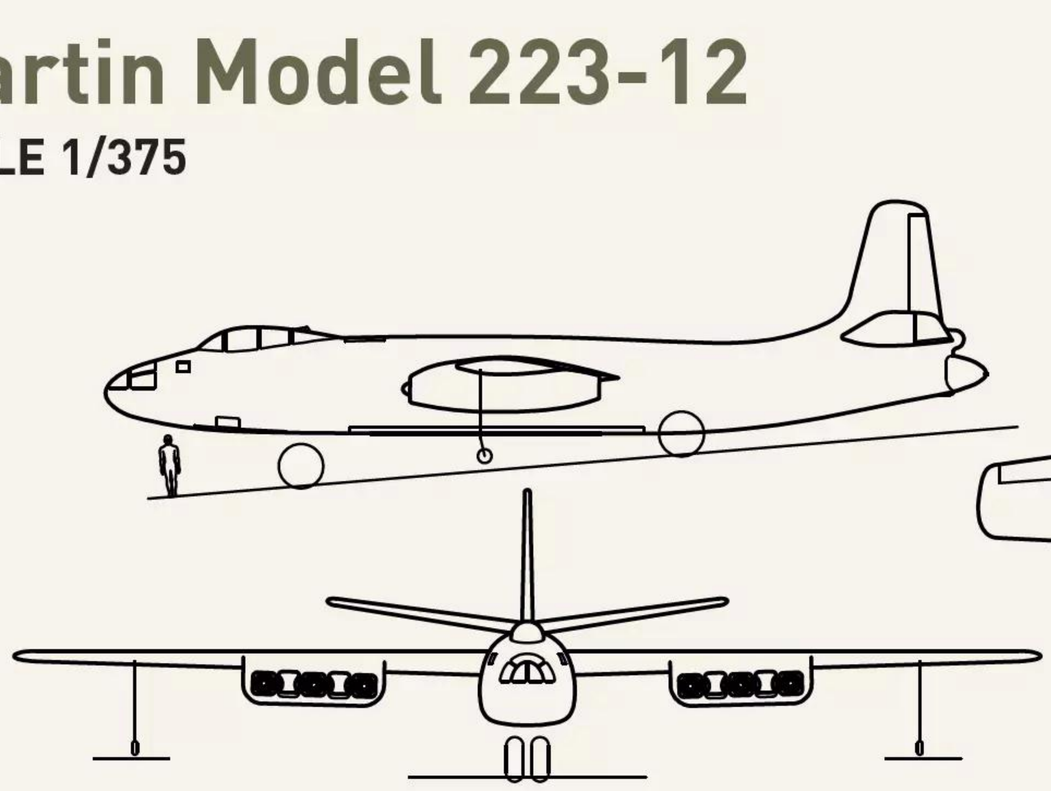

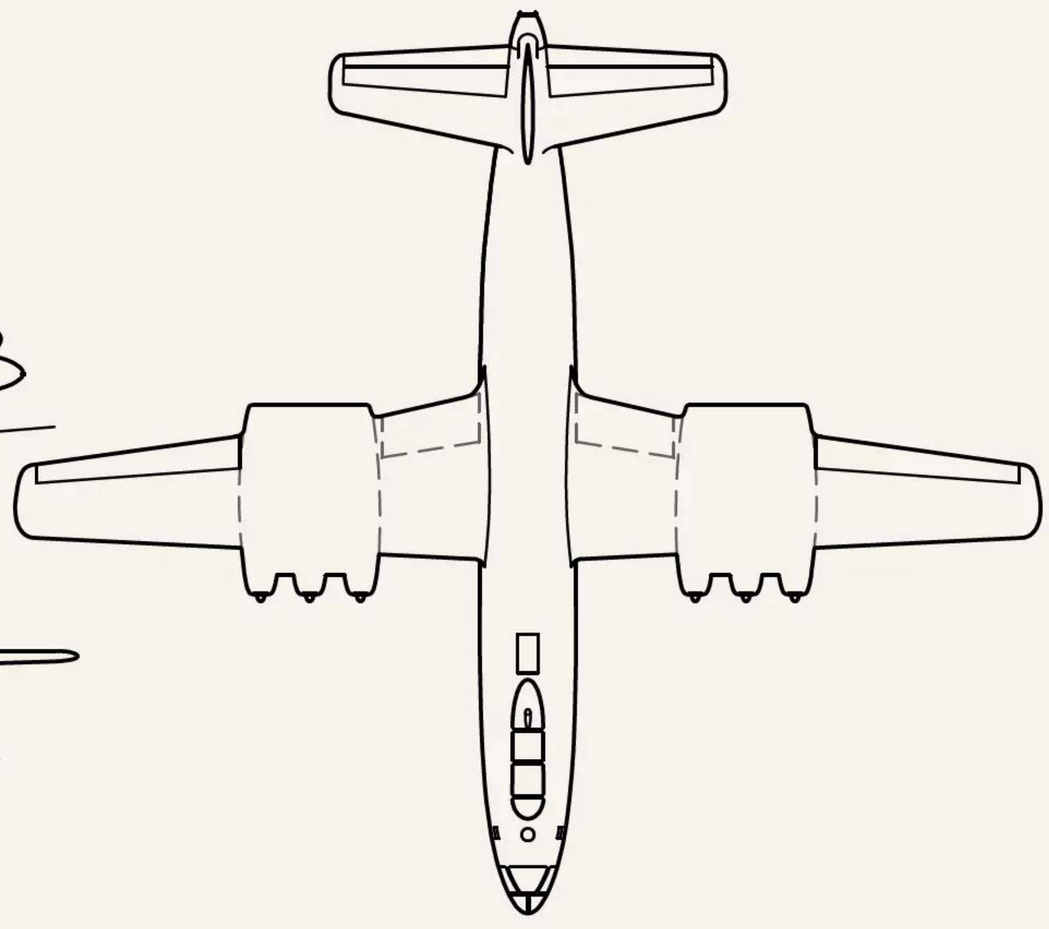

controlled ball turret was built into the starboard tail. Wingspan was 104ft, while the longer port fuselage had a total length of 71ft 10in. One turbojet was tucked under each wing root.

With a configuration like this, care would have to be taken with dropping the bombs. With widely separated fuselages, centre of gravity issues could easily become very important if the bomb load was unevenly distributed.

The Model 223-5 configuration was similar to that of Model 223-3, having essentially the same fuselage, aft-located wing and canard. However, unlike the earlier design's twin tailbooms and two body-mounted engines, the -5 had two-engine pods attached to the undersides of its wings. A single vertical fin at the tail of the fuselage provided stability. The wings were moved upwards compared to Model 223-3; this provided room for the main landing gear to fold up into the forward portion of the engine pods. By moving the spar upwards, the lower fuselage was opened up, allowing the forward and aft bomb bays of the Model 223-3 to be moved next to each other, simplifying sudden CG-shift issues. The bomb load was probably the same as that of Model 223-3, but the nose reverted to a glazed configuration for the bombardier. There was again the ubiquitous ball turret in the tail.

The Model 223-6 configuration was a return to conventional layout, similar to that of Model 223-2. Where the earlier design had one turbojet at each trailing edge root and one engine mounted just below the leading edge at about 1/3 span, the 223-6 put the engines side-by-side at the trailing edge root. A single wide inlet in the leading edge fed each pair of engines. Otherwise, the 223-6 was pretty much a copy of the 223-2. The bomb load was almost certainly the same as that of the Model 223-2 and there was the usual ball turret in the tail.

The Model 223-7 configuration was very much like that of the 223-6, just with the engines moved. Instead of being located side-by-side at the wing roots, each pair of engines was stacked vertically at about the 1/3 span position. The result looked not unlike the Short SA.4 Sperrin bomber. Two prototypes of this British aircraft were built, the first of which first flew in 1951. While the Sperrin was not put into production (it was a conservative fallback design in case problems were encountered with the more advanced 'V-bombers'), the two prototypes did fly well and proved that that engine configuration was practical.

An advantage to the vertically stacked configuration is that the main wing spars can pass between them, unimpeded. Designs like the 223-6 have engines and inlets in the middle of the wings, requiring complex and heavy contours for the spars. Like the 223-5, the nose was glazed.

Model 223-8 was largely the same as the 223-7 but with a change in engine location. The engines were separated and buried within the wing, projecting well aft of the trailing edge with leading edge elliptical inlets. One engine was buried in the wing root, another at about the 1/3 span position. This would have required that the spars have holes in them to allow the inlet ducts to pass through.

Model 223-9 had an airframe seemingly identical to the 223-8 but with an extra pair of engines. As with the 223-8, one engine was buried in each wing root, but where the 223-8 had a single engine at about the 1/3 span position, the 223-9 had two engines in a common nacelle.

Model 223-10 was a conventional configuration with four jet engines. The engines were mounted in twin-jet pods attached to the underside of the main wing. The main landing gear was stored within the lower rear portion of the engine nacelles. This design seems to have gone back to the solid nose, though the inboard profile is rather crude and incomplete, not showing the bombardier's position.

Model 223-11 established the final overall configuration for the XB-48. This design featured the two nacelles of three engines that would characterize the XB-48, including the unique 'wind tunnel' gaps between the engines that were meant to increase lift (testing of the XB-48 showed, though, that they primarily served to increase drag). Model 223-11 was a little smaller and slimmer in appearance than the XB-48.

Model 223-12 was the penultimate design iteration. Very similar to Model 223-11, the -12 differed in having the wings moved upwards slightly, quite different landing gear (two pairs of large wheels with small outriggers in the engine pods, as compared to the -11's large pair of main wheels, a single smaller nose wheel and small outriggers) and a more conical tail turret.

On December 9, 1944, the Glenn L. Martin Company submitted their final Model 223 proposal for preliminary engineering and mockup construction; one week later the Material Division in Washington, D.C. authorized Martin to proceed with wind tunnel models and testing. A cost-plus contract for further testing was approved in April 1945. In June 1945 Martin submitted their proposal to actually build the Model 223, dubbed the XB-48; the Army Air Forces approved the construction of two flying prototypes. The XB-48 was seen from the outset as a fallback option in case the Boeing design failed.

Where the XB-46 was sleek and gorgeous, the direct competitor from Martin, the XB-48, was… well, the opposite. The two XB-48 aircraft were stout beasts with six engines; laid out with the same basic plan as the B-45 and XB-46. But the fuselage of the XB-48 was as graceful and elegant as a grain silo, with a long straight section with a flat underside and a fairly blunt nose. Rather than a harbinger of the jet age, the XB-48 looks almost as if it would have been at home next to an Avro Lancaster.

The XB-48 had what its designers called a 'horizontal bomb bay', rather than a conventional 'vertical' bomb

Martin XB-48

SCALE 1/175

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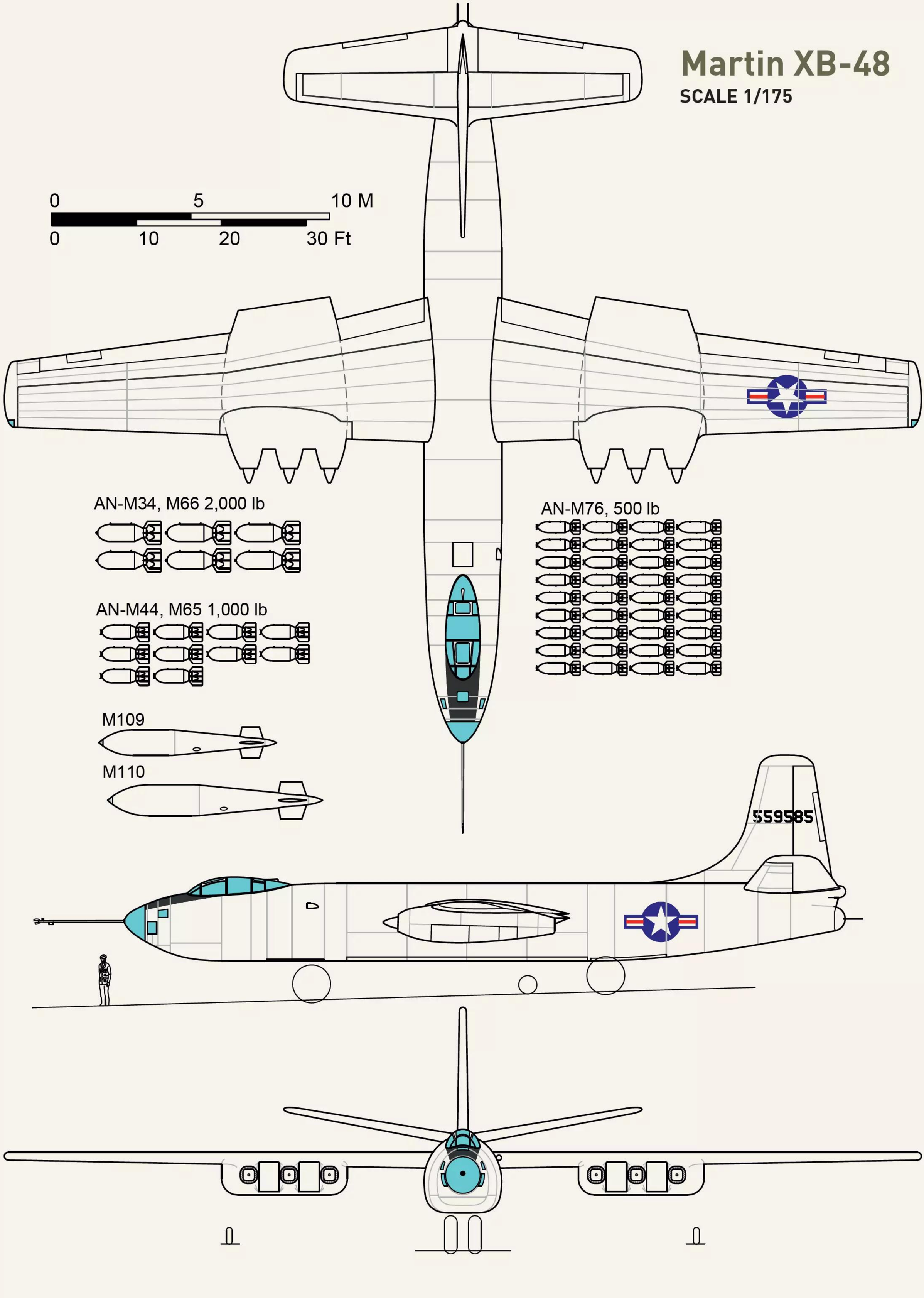


AN-M34, M66 2,000 lb

AN-M76, 500 lb

AN-M44, M65 1,000 lb

M109

M110

559585

Jet Bomber Competitors

SCALE 1/325

Convair XB-46

Martin XB-48

Boeing XB-47

Boeing B-29

North American XB-45

0 5 10 M

0 10 20 30 Ft

bay. By this they meant that a conventional bomb bay filled the fuselage from top to bottom, while the XB-48's bomb bay only filled roughly the lower half of the fuselage. The wing spars and several fuel tanks filled the volume above the bay. The bay might not have had much depth, but it was quite long… more than long enough to accommodate the Grand Slam, as well as a wide variety of other bombs from 250lb to 4,000lb. The bomb bay doors were the full length of the bay and retracted within the outer mold line of the aircraft, reducing drag.

The landing gear was, like that of the B-47, a 'bicycle' arrangement, with one two-wheel bogey just ahead of the bomb bay and another just aft of the bay. Small outrigger gear retracted into the outboard side of the engine nacelles.

The one truly unique feature of the XB-48 was the engine nacelles. They, like those of the Boeing B-47, each held three turbojet engines, but they were arranged in a way that no other aircraft ever has, before or since. The three engines were side-by-side but with sizable rectangular cross-section ducts between them. The theory was that this would reduce drag compared to a single unbroken nacelle. The NACA was consulted in 1945 and initially concluded that a single 'egg' with three engines would be more aerodynamic. The issue was to be resolved with a series of wind tunnel tests… but these were cancelled when it was realised that the actual aircraft would be completed before the wind tunnel tests could be carried out.

The first flight of an XB-48 occurred in June 1947. The two aircraft flew well, but flew slow compared to the B-47. The unusual nacelle configuration produced more drag than hoped; at high speeds the ducts produced a high airspeed venture effect. Flight tests of the two aircraft ended in mid-1951 with both airframes being scrapped. Martin could see the writing on the wall for their design; the B-48 was simply never going to be as fast as the B-47. So in January 1949, Martin proposed to convert the second XB-48 into the Model 247-1. The jet engines and nacelle would be removed and replaced with four XT-40 turboprops. The resulting aircraft would be even slower – but it would be more fuel efficient. The Air Force, however, turned this idea down.

While Boeing's B-47 proved itself, it did so in an era of rapidly advancing technology and constantly shifting priorities. The 1940s had seen a constant stream of new aircraft, and the rise of jet technology promised more of the same. So it comes as no surprise that in 1948 the US Air Force requested proposals for a jet bomber that was aimed at being something of a replacement for the B-47. The B-47, after all, had begun life in 1944, a full three years earlier… and that was an eternity. The previous three years had seen aircraft progress from propellers to jet engines to rockets, from 400 miles per hour to breaching the sound barrier. Thus, even though the B-47 had not yet had its first flight, it was clearly time to look at what would come next. Project MX-948 called for studies on the next generation of medium jet bombers. Information on this project and the proposals that followed along is sparse and in some cases uncertain.

Lockheed L-173

Lockheed had not participated in the 1944 jet bomber contest, but they tried to correct that with their L-173 project. Some number of designs were studied, including jet propelled, turboprop powered and mixed systems, but the only design known with any certainty is the L-173-15, which seems to be the final configuration. As with the B-47, the L-173 was a six-engined jet bomber with swept wings, but that about ends the similarities. It featured a circular cross-section tubular fuselage with a crew of eight up front and two gunners in a separate unconnected pressurised section in the rear fuselage (this seems unlikely and unusual… a crew of ten is a shocking number for a medium bomber meant to replace the three-seat B-47, and while an available inboard profile depicts eight crew in the front, no crew positions in the rear fuselage seem to be visible).

For defence, the aircraft was equipped with a retractable spherical turret under the forward fuselage with two 20mm cannon, a turret on the upper rear fuselage just ahead of the vertical stabilizer with two 20mm cannon and a tail turret with four 20mm cannon. The abundance of defensive guns indicates that Lockheed assumed the L-173 would operate in a space swarming with enemy fighters able to exceed its altitude and speed performance.

The engine arrangement for the L-173 was a bit unusual. Two engines were located in a nacelle just inboard of half span… but unlike the B-47 nacelle, the engines were stacked vertically, with the upper engine staggered slightly forward of the lower engine. The reason for this is not clear; doubtless it would have made maintenance access to the engines, especially the upper engine, rather interesting. A single engine nacelle was mounted below each wingtip.

The wings were aft-swept, but less so than on the Boeing B-47, with 20° sweep at the quarter-chord line. Also, as with the B-47, landing gear was of the bicycle type with outriggers dropping from the engine nacelles.

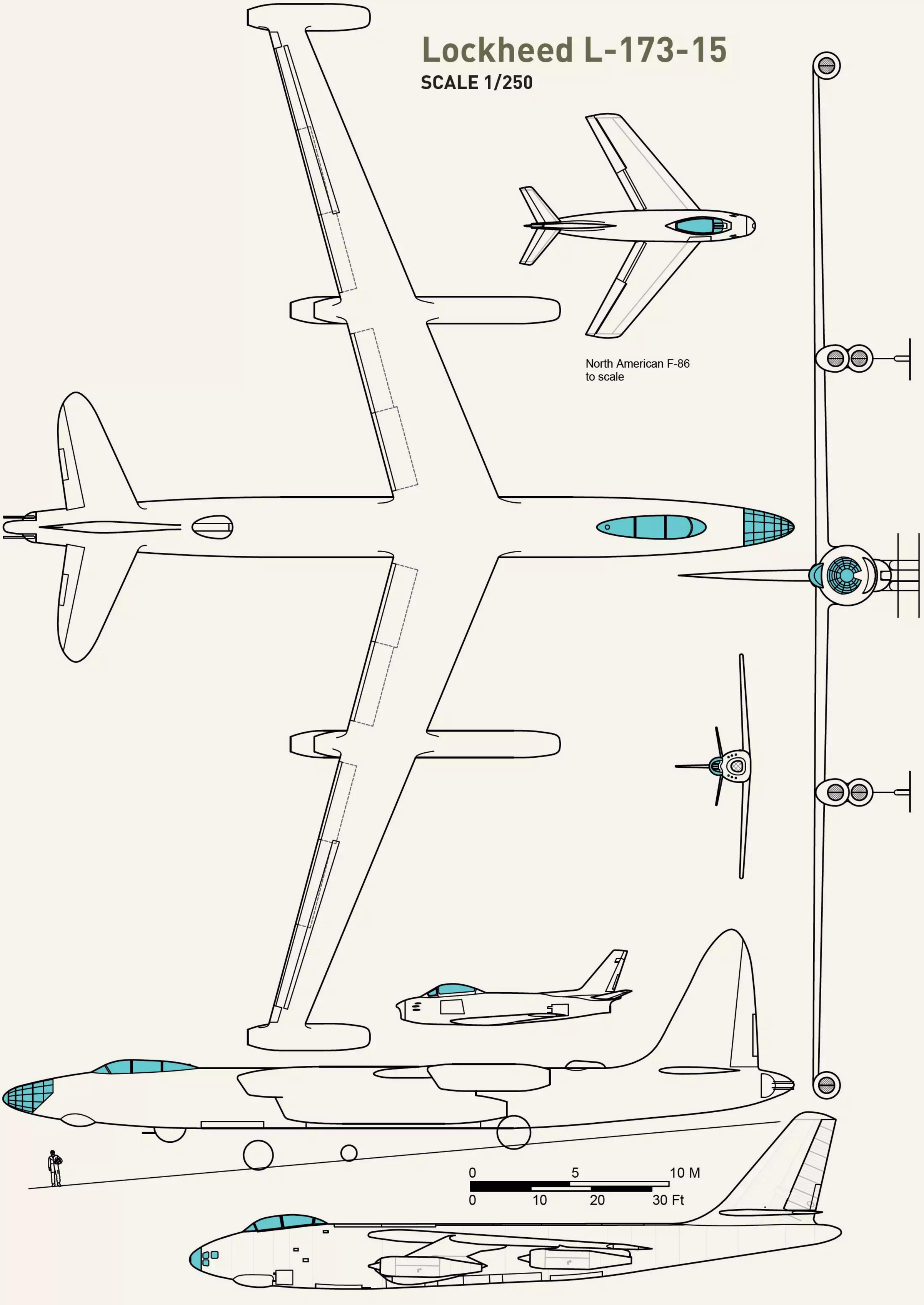
Northrop N-31

In January 1948, several designs for the Northrop N-31 series flying wing bombers were unveiled. It is uncertain whether these designs were initiated for the MX-948 programme, but the timing seems about right and the aircraft seem to fit the role. These aircraft were advancements upon the existing B-35 and B-49

Lockheed L-173-15

SCALE 1/250

North American F-86
to scale

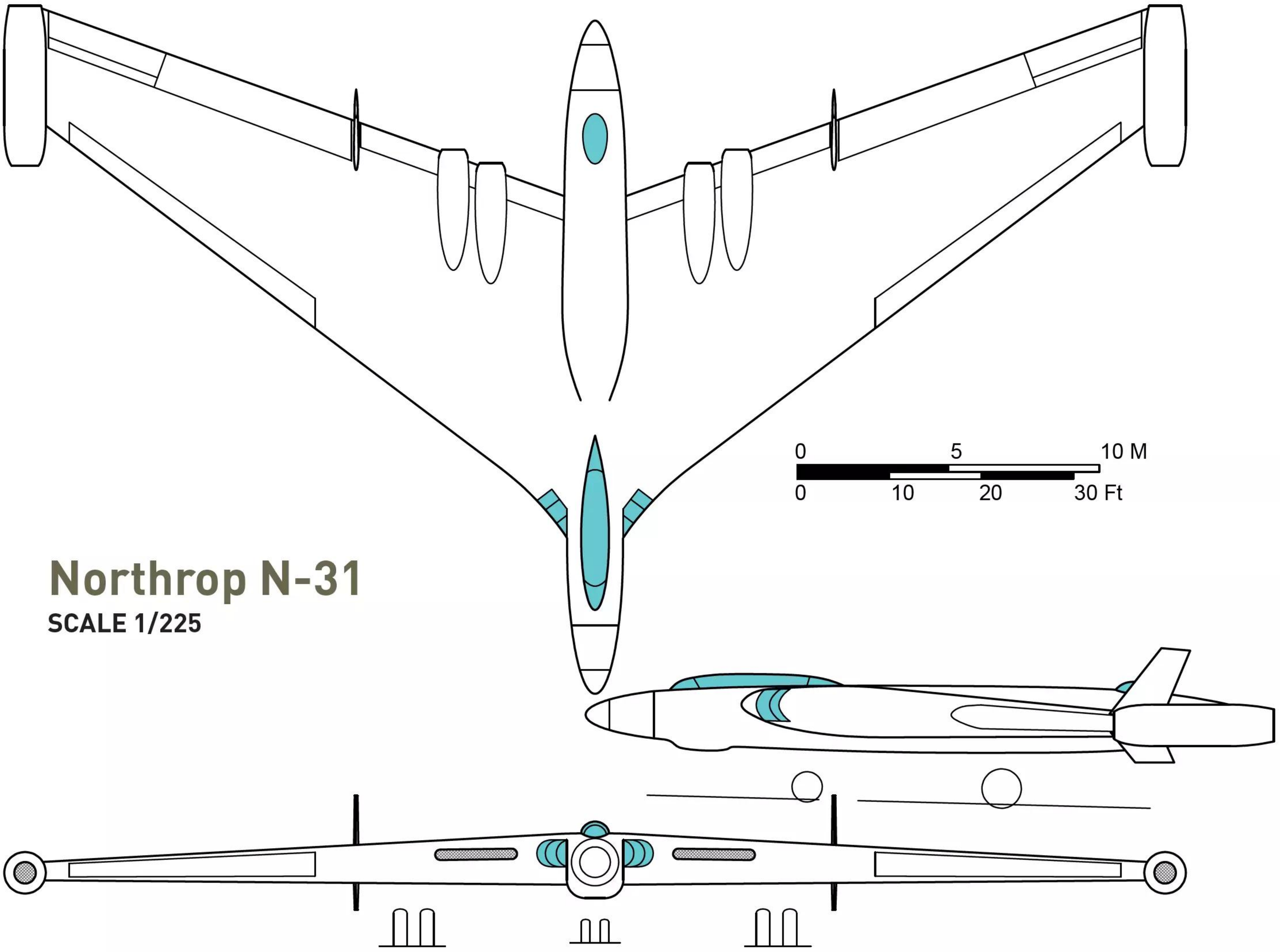


Northrop N-31, Turbodyne Engine

SCALE 1/225

0 5 10 M

0 10 20 30 Ft



Northrop N-31

SCALE 1/225

flying wing bomber designs, using somewhat different planforms. They featured more highly swept wings of somewhat shorter span and included central fuselages with noses that projected well ahead of the wing leading edge. The fuselage provided the volume necessary to carry a single Grand Slam bomb.

Two designs were initially put forward, N-31 and N-31A. Data on them is sketchy. N-31 used an all-jet propulsion system while N-31A used turboprops. Both designs had a range of 2,781 miles; N-31 could reach a top speed of 520mph, while N-31A could reach 510mph.

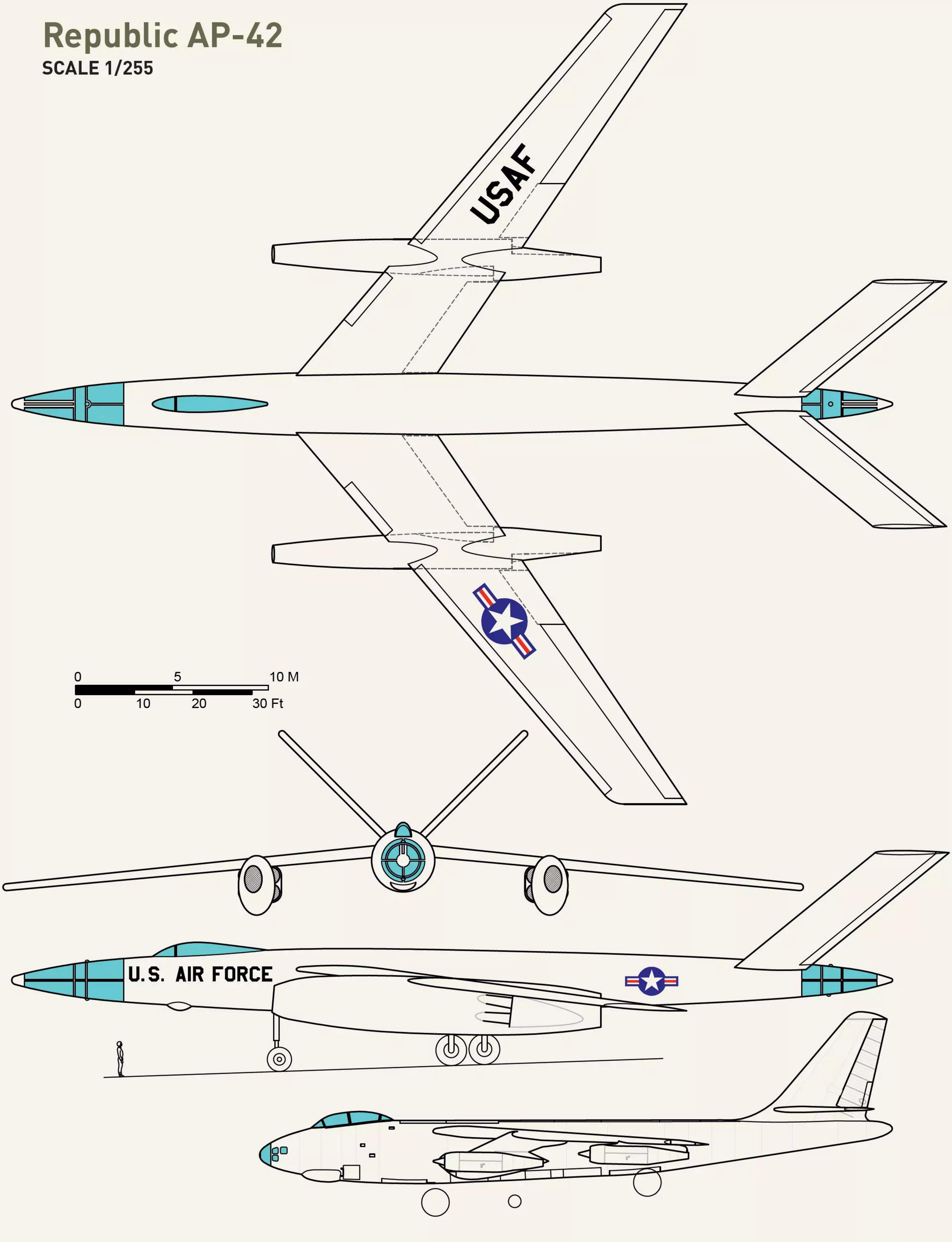
In May 1950, revised versions of N-31 were revealed. Specific aircraft designations are unavailable for them; the information comes from a promotional brochure which does not provide nomenclature. Two different engine types were considered, with either two or four engines per plane.

A crew of five was contemplated for these designs, with two crewmembers in a tandem cockpit similar to that of the Boeing B-47… and indeed for almost all medium bomber designs of the era. Two other seats were located in the leading edges of the wing roots and were provided with large windows for forward visibility. A tail stinger was provided with a remote gun turret containing two or four machineguns (probably .50 calibre). Inflight refuelling was planned for long range bomb runs; speed and manoeuvrability were expected to be such that fighter interception would be extremely difficult.

The primary version was equipped with two Turbodyne V (also known as the XT-37) turboprop engines, each driving a six-bladed counter-rotating propeller. The Turbodyne was a large turboprop engine developed in-house at Northrop; each engine could put out 10,400 horsepower. The alternate version was equipped with four Allison XT-40 turboprops, providing a total of 30,000 shaft horsepower. The propeller arrangement was divided into four six-bladed counter-rotating props. Otherwise, the design was essentially identical to the

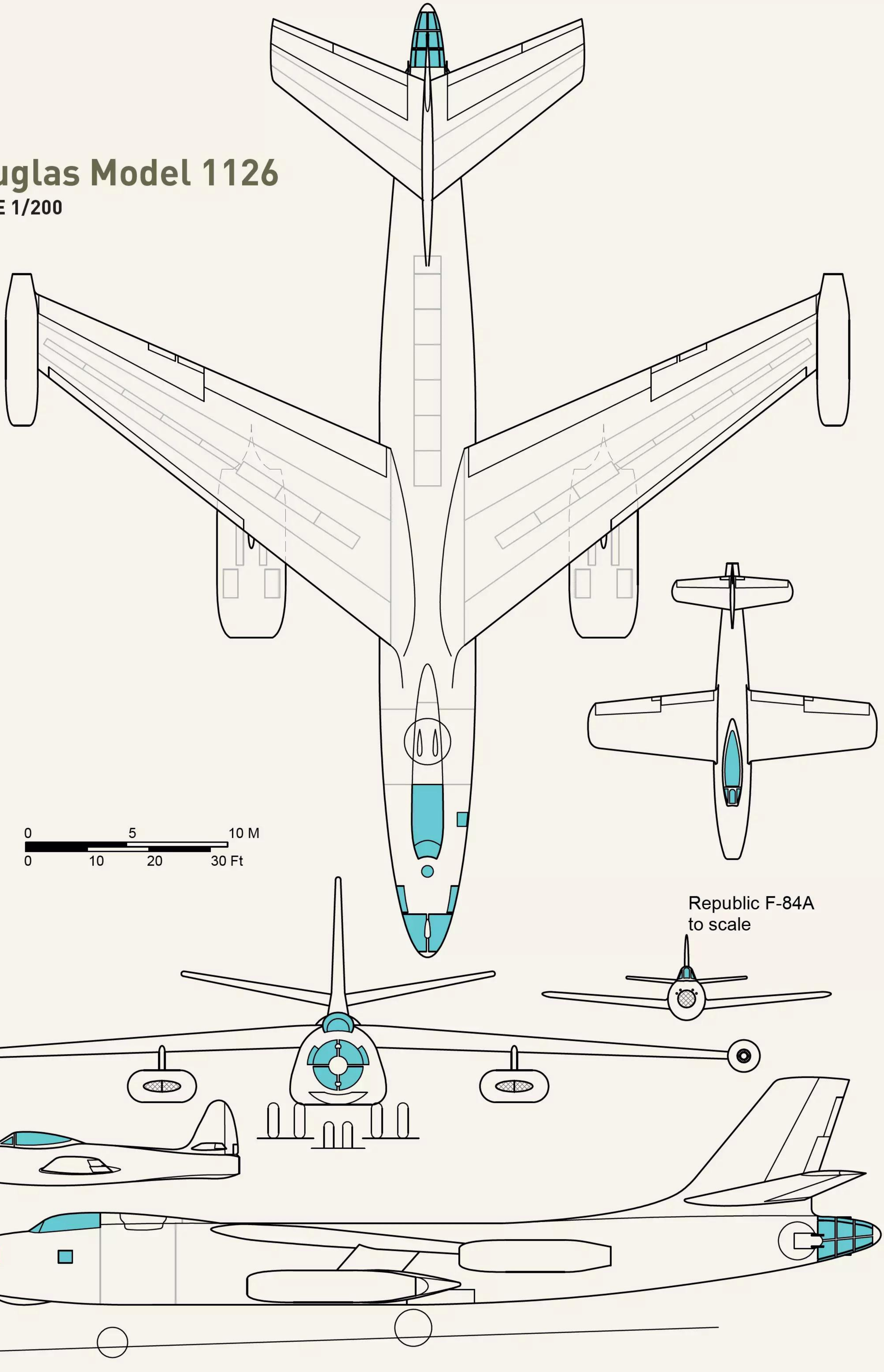
Republic AP-42

SCALE 1/255



Douglas Model 1126

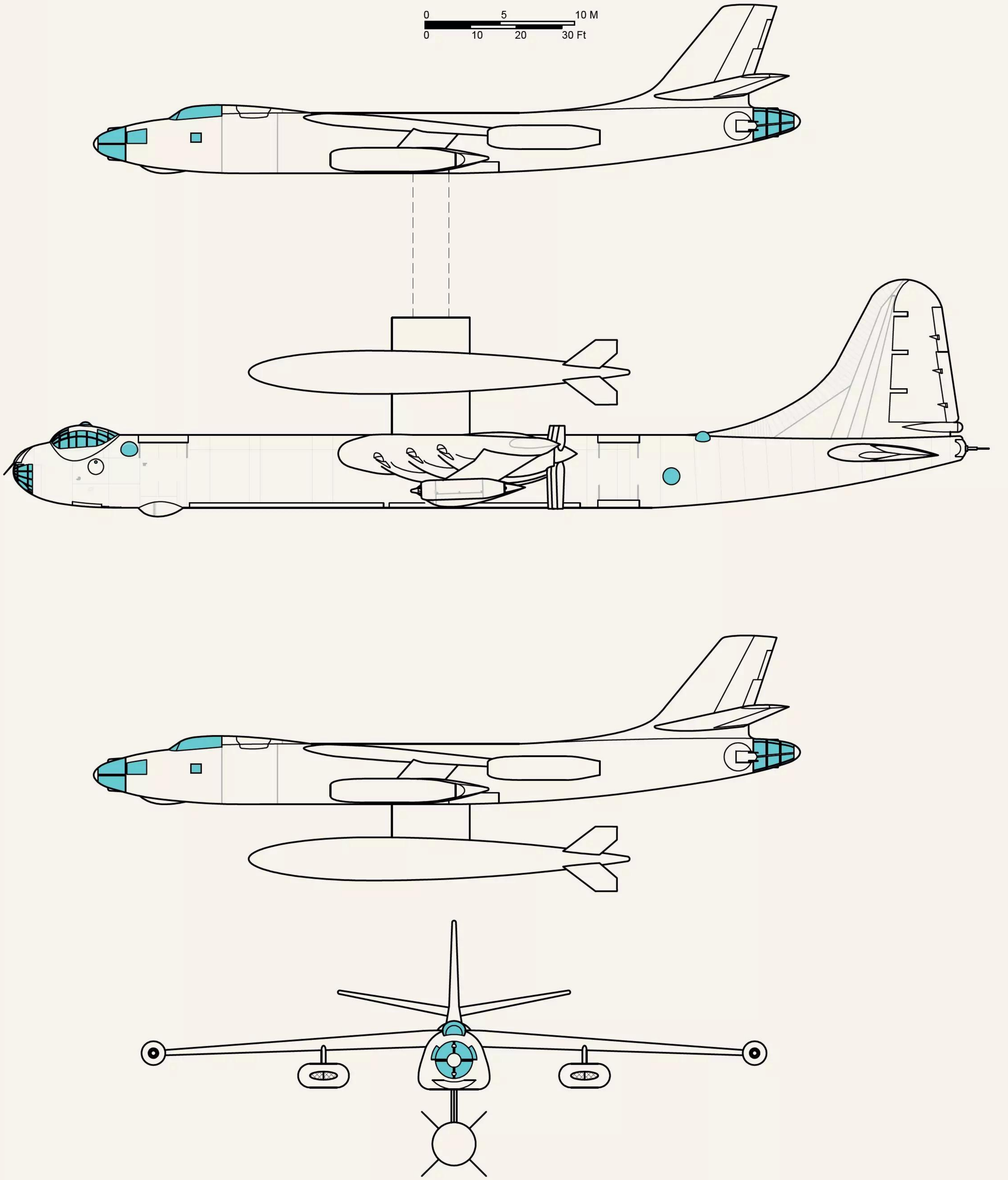
SCALE 1/200



Republic F-84A
to scale

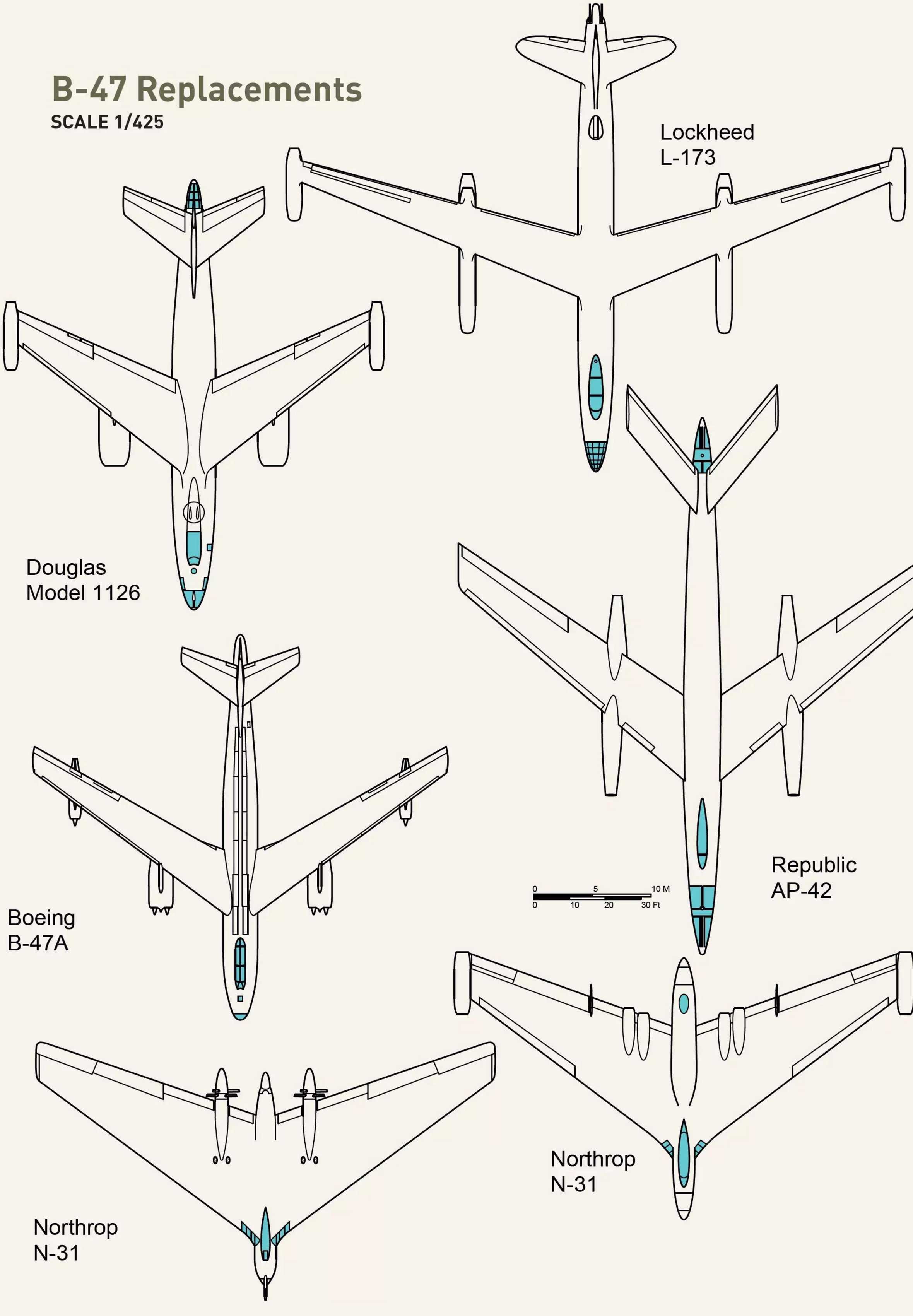
Douglas Model 1126 + B-36 Tanker

SCALE 1/275



B-47 Replacements

SCALE 1/425



Turbodyne V variant. Performance was lower than that of the Turbodyne V version.

Republic AP-42

The Republic response to MX948 is believed to be their AP-42 concept, for which minimal data is available. In fact, all that seems to currently exist for it are a few photos of a display model. Consequently, anything that can be said about it must be taken to be provisional or speculative; hopefully someday the proposals or other design diagrams and data will come to light.

The model depicts a swept-winged aircraft with a spindle-shaped fuselage and a narrow-chord V-tail. The most unusual feature was the arrangement of the engines. At first glance it appears to have two nacelles with two engines in each… but it actually has four engines in each nacelle. Two engines were stacked vertically and fed from an elliptical inlet at the front, and exhausted through two nozzles on the outboard surface of the nacelles, about 2/3 of the way back. Two more vertically stacked engines were located at the extreme rear of the nacelles; they were fed from inlets on the inboard side of the nacelles, just forward of the outboard exhausts, and exhausted from the tail of the nacelles.

The sole indication of the size of the aircraft is a crude human figure next to the model in the photos. Dimensions for the aircraft were assessed from that figure when this author created diagrams; due to uncertainty both in the accuracy of the little figure and in assessing the figure, dimensions given in the data table should be taken with a grain of salt.

Douglas Model 1126

Douglas' proposal for MX-948 was the conventional-looked Model 1126 from August 1948. This aircraft looked like nothing quite so much as the Boeing Model 450-1-1 from 1946, with twin-engine nacelles pylon-suspended beneath swept wings, and single engine nacelles on the wingtips. At least two major variants of the Model 1126 are known, differing largely in the wing… one had a span of 102.2ft, the other 140ft. The fuselages were also a bit different in length; the smaller design was 119.9ft in length, the longer, 28ft 2 inches. The diagram included here is of the smaller design.

Unlike the Lockheed, Northrop and Republic designs, the Douglas vehicle seemed almost shockingly conventional. But Douglas was not to be outdone in 'innovation' or 'weird.' In order to get the maximum possible range, the smaller version would be fuelled in mid-flight. As inflight refuelling had not yet been as perfected and standardised as it has since become, Douglas suggested a refuelling method that was unique, to say the least. Instead of meeting up with a tanker aircraft and taking on fuel through a probe or a hose, the 1126 would rendezvous with a B-36 bomber carrying a relatively gigantic 'drop tank' above the fuselage. The 1126 would – almost magically, it would seem – latch onto the tank with cables; the B-36 would detach the tank and the 1126 would reel it in, latch on and tap into it. The idea seems outlandishly unlikely to work in actual practice, especially in wartime; but this was an era when parasite fighters were being seriously proposed to be carried in bomb bays or attached to wingtips. The larger version was probably not intended to have to undergo such inflight machinations in order to attain its maximum range.

The Model 1126 had seven crew in the forward fuselage, and another in a rear pressurized section. The rear position was of course the tailgunner; he operated an unusual system composed of two separate turrets each with two 20mm cannon, one turret on either side. Gunners in the forward section operated retractable turreted cannon located above and below the fuselage just behind the cockpit.

The fuselage was distinctly non-circular in cross section, having a flat underside akin to that of the Martin XB-48. Performance and weight data is currently unavailable for the Model 1126, but cutaway artwork depicts it with a Grand Slam-like bomb, but notably smaller in diameter. It's unclear if this was meant to represent an unusual conventional bomb (possibly a deep penetrator of ground or armour) or if it was a stand-in for a nuclear bomb.

CHAPTER 2

Derivatives of the B-47

The fixed-price contract that turned the Boeing Model 450-3-3 dream into the XB-47 reality was signed on July 10, 1947. This called for the construction of two prototype aircraft for flight testing, not fitted out for operational duty. But the XB-47s had begun more than a year earlier in June 1946, when the US Army Air Forces approved Boeing to go ahead with construction of a pair of prototypes. Work on these began soon thereafter at the Boeing plant in Seattle. They were not built with production-style jigs and manufacturing, but instead were essentially hand-made. Nevertheless, in what today would be considered blistering speed, the first of them was rolled out on September 12, 1947, to a combination of astonishment and apathy: the design was amazing looking, but it seems many people at the time thought its chances of success were poor.

XB-47 Model 450-3-3

The XB-47s as built were indeed futuristic looking for the time. Swept wings were something the public was largely unfamiliar with; in fact, just a month later the Bell X-1 piloted by Chuck Yeager would break the sound barrier for the first time… and do it with straight wings.

But while the XB-47 did not have the X-1's now-antiquated unswept wings, it did have something in common with the X-1: rocket propulsion. The early TG-180 engines were marginal at best for heavyweight takeoff. So to assist, the XB-47 had built into the port and starboard sides of the rear fuselage fittings for solid rocket rocket-assisted take-off units, colloquially often known as 'RATO bottles'. Each side could hold nine Aerojet rockets (with a mix of potassium perchlorate and asphalt propellants), each producing about a thousand pounds of thrust for a total of 18,000lb. This did not quite double the 22,500lb of thrust that the jet engines could produce, but for the dozen seconds the rockets operated they could hurl the aircraft up off the runway… and if the pilot wanted to abort a takeoff, he had to wait until the rockets burned out.

The solid rockets were considered an interim solution to the problem of marginal takeoff thrust; with the inert weight of the steel bottles and the vast clouds of impenetrable smoke, what Boeing really wanted was a liquid rocket system. A system like that would weigh less and perform better, but it was not yet ready. So the solid rocket was the best solution at the time.

The first prototype – which took to the air for the first time on December 17, 1947 – was fitted with TG-180 B1 turbojet engines (aka J35-GE-7), while the second prototype had TG-180 C1 engines (J47-GE-9). Both types of engines produced 3,750lb of thrust. As mentioned, these engines were marginal at best for takeoff, but for flight at the desired speed and altitude they were just fine. Cruising is generally one of the least taxing things that a subsonic aircraft can do; it is at takeoff that an aircraft needs maximum possible thrust and maximum lift. Much less thrust is needed in the air than on the runway.

The configuration of the XB-47 was largely that of the production B-47s that would follow… the original design turned out to be an excellent one. One of the few major changes was that the first prototype had leading edge slats on the wings outboard of the engine pylons. Intended to help the B-47 during low-speed landings, testing showed that the aircraft didn't need them and they were never again included.

The XB-47 was not equipped with weapons, either offensive or defensive.

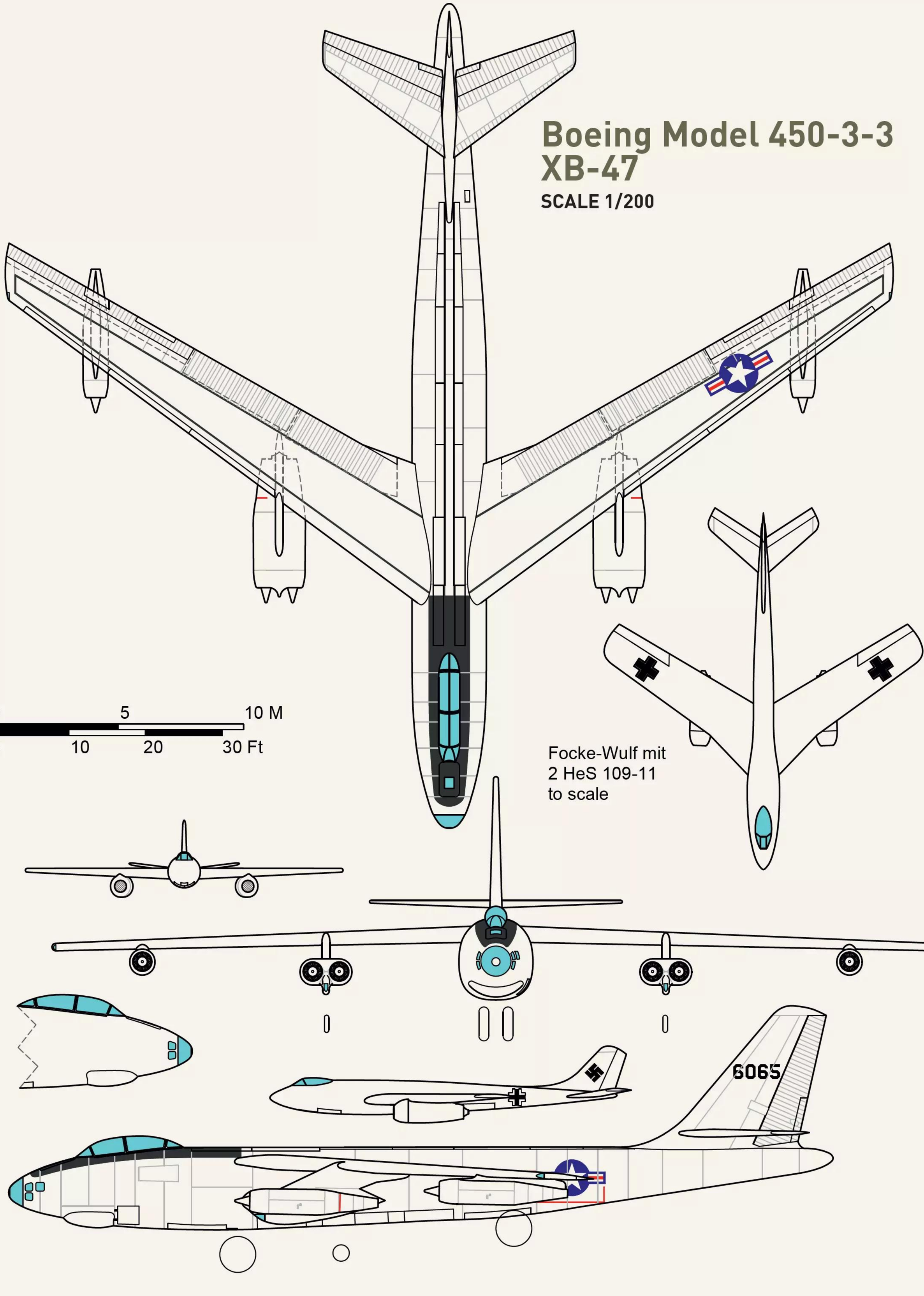
The three crew of the XB-47 were each given ejector seats. The canopy would be blown off to allow the pilot and co-pilot to eject safely; a hatch in the top of the nose ahead of the pilot's canopy would blow off to provide a safe exit for the navigator. The main entrance was a hatch located on the lower port side of the forward fuselage.

B-47A Model 450-10-9

Ten B-47A aircraft were built (in Wichita, rather than Seattle), with first rollout in March 1950 and first flight in June. They were essentially identical in configuration to the XB-47 with little to visually distinguish them. They were used largely for training and testing, with functional bombsights, navigation equipment and autopilots installed. Only the seventh of the ten B-47As had a functional tail turret, an Emerson A-2 with two .50 calibre machine guns, the rest instead having an aerodynamic fairing. Problems with Emerson – technical and managerial – meant that defensive armament was simply not available for use on the B-47A. Propulsion was provided by six General Electric J47-GE-11 turbojets (5,200lb of static thrust each) and eighteen Aerojet 15KS-1000 solid rockets for takeoff.

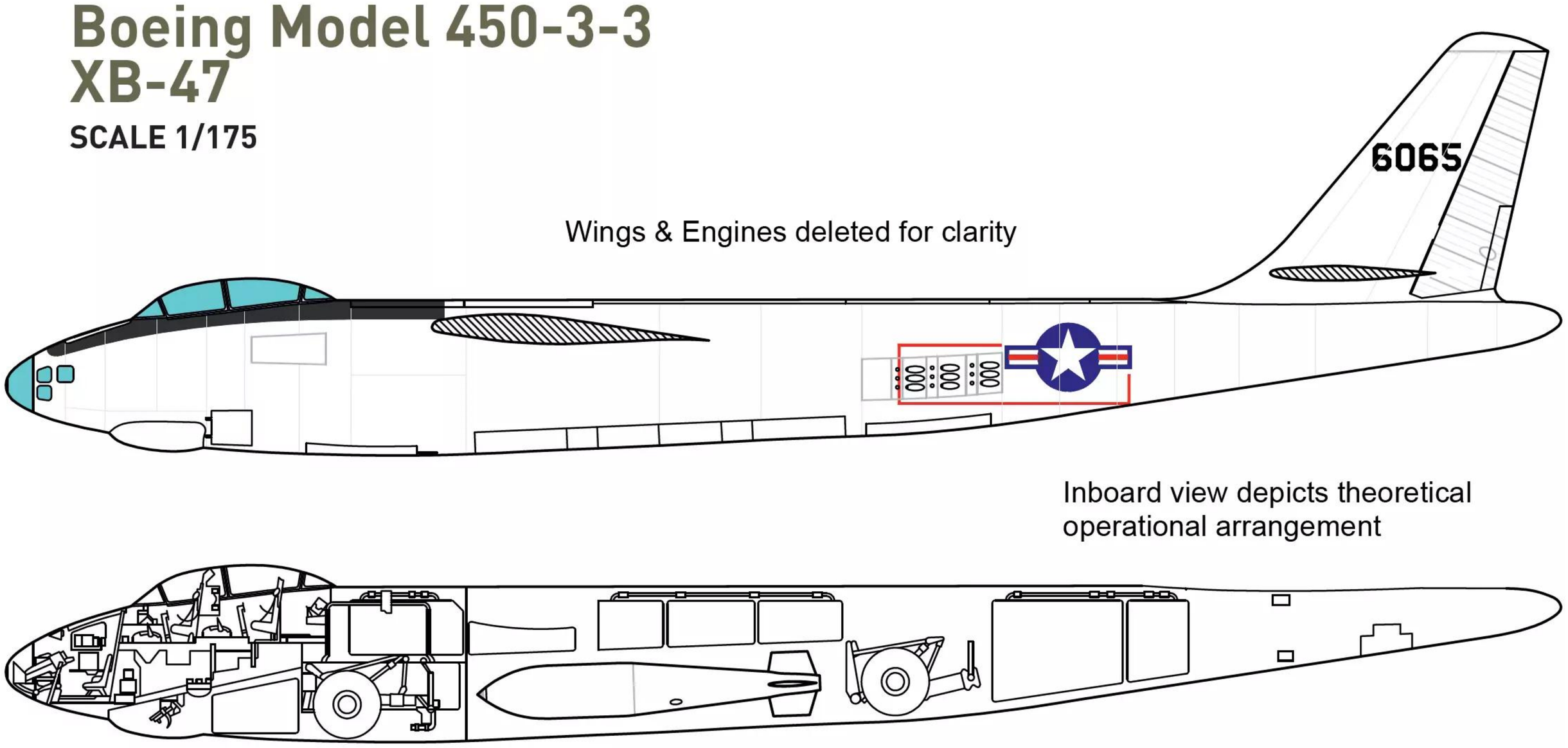
Boeing Model 450-3-3
XB-47

SCALE 1/200



Boeing Model 450-3-3
XB-47

SCALE 1/175



The first B-47A was delivered to the NACA Langley Aeronautical Laboratory in July 1952 for flight testing. The B-47 was so far into the unknown in terms of design and performance that the NACA wanted to study the aeroelastic effects of high speed on the structure… essentially they want to watch the plane bend and warp at high speed. To this end they added a long pitot tube to the nose with angle of attack and angle of yaw sensors, as well as many more sensors to watch how the plane reacted. Above the fuselage, behind the cockpit, the NACA added an 'optigraph', a camera system that recorded and measured changes in the positions of spots on the wings.

B-47B Model 450-67-27

The B-47B was the first operational version of the B-47, and with 399 built, the first to be put into true mass production. First flight of the B-47B occurred in April 1951. At first glance the most obvious change from the B-47A was to the nose: gone was the symmetrical glazed nosecap. Now fitted was an asymmetrical metal nose with a Y-4 horizontal periscopic bombsight projecting from the slightly offset nose. A small hemispherical glass dome with a retractable metal cover gave the bombardier sitting in the nose of the aircraft a view of the target area below. Coupled with the APS-23 ground-viewing radar, the bombardier was given a good shot at spotting, and with luck, hitting the target.

The end of the vertical stabilizer was squared-off, no longer rounded as it had been on the XB-47 and B-47A. The arrangement of the JATO bottles was also slightly adjusted; each side still had three rows of three columns, but the middle row was moved forward slightly.

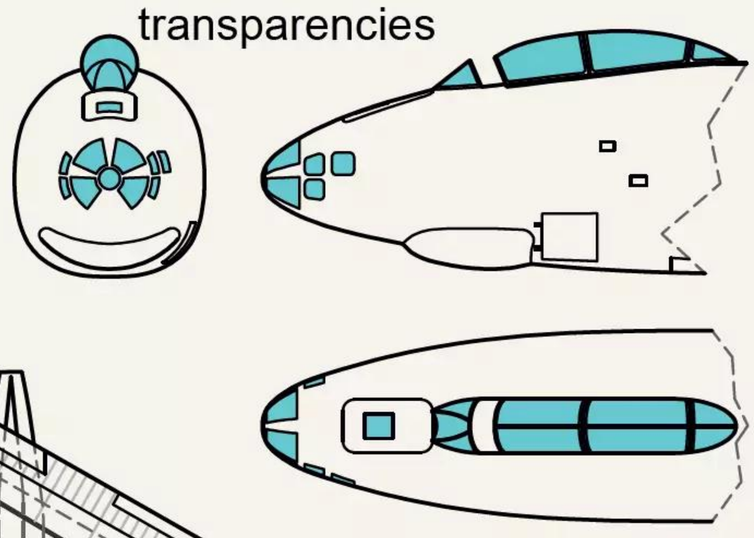
The B-47B was at last given both offensive and defensive weapons. The bomb bay was produced in two sizes… the long bay as introduced on the XB-47 and built on the B-47A, and a shorter bay. When originally designed, the bomb bay was needed to carry the largest 'blockbuster' bombs, both for themselves and to serve as a proxy for the largely unknown world of atomic ordnance. But as the 1950s dawned, thermonuclear weapons were becoming understood. Megaton-class bombs were hefty chunks of canned sunshine to be sure, but nowhere near as massive as the Tallboy. Consequently the bomb bay was shrunk, just big enough to carry a single sizable thermonuclear weapon. The rest of the space was filled with a new fuel tank, boosting range.

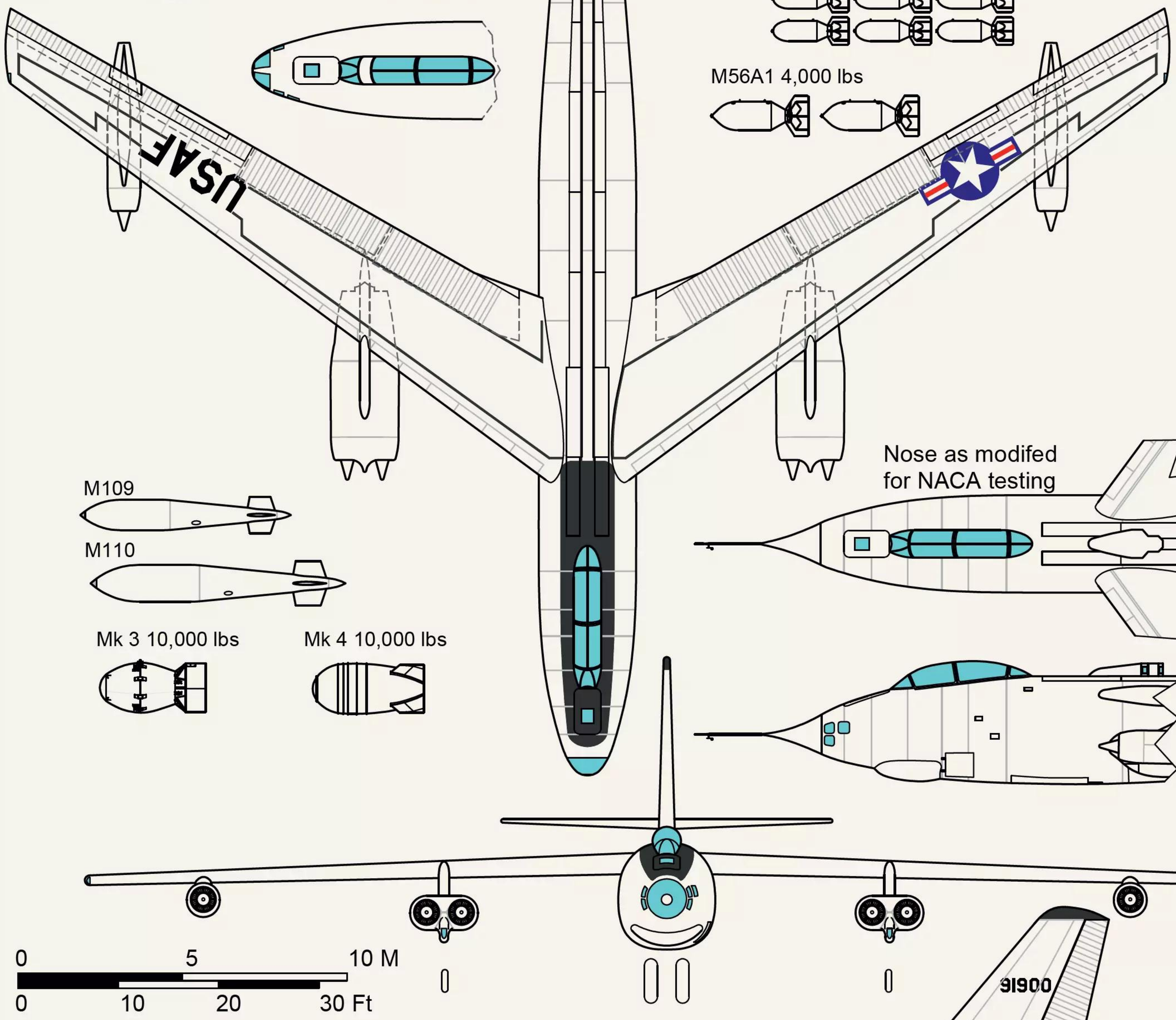
The ongoing problems with Emerson meant that early B-47Bs were delivered with no defensive armament, just an aerodynamic fairing at the tail. A number of the Emerson A-2 turrets were available, though not what was really wanted; still, two .50 calibre machine guns is better than nothing so with some modifications and improvements the A-2s were converted into B-4 turrets and 282 of them were installed on B-47Bs starting in late 1952. Unfortunately, the B-4 turret was a relatively long 'tail,' and when it aimed left or right it worked as a small but effective rudder, playing hell with yaw control at high speed. Fortunately, the General Electric A-5 turret with two 20mm cannon was produced. This was an outgrowth of the tail turret used on the Convair B-36, a spherical 'ball' turret that did not work like a rudder. Beginning in

Boeing B-47A

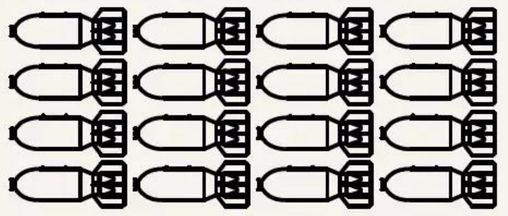
SCALE 1/200

Later nose transparencies

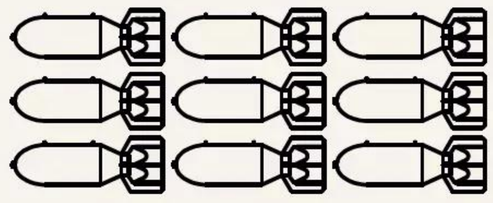




AN-M44, M65 1,000 lb



AN-M34, M66 2,000 lb



M56A1 4,000 lbs

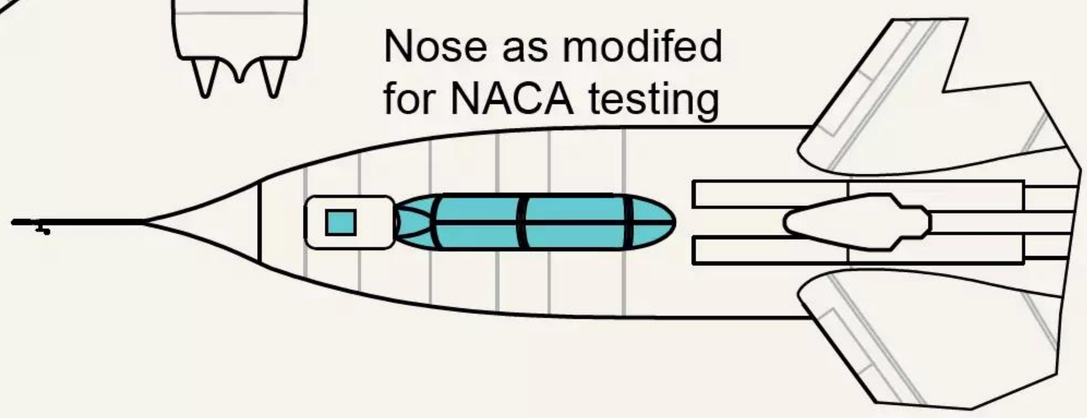
M109

M110

Mk 3 10,000 lbs

Mk 4 10,000 lbs

Nose as modifed for NACA testing



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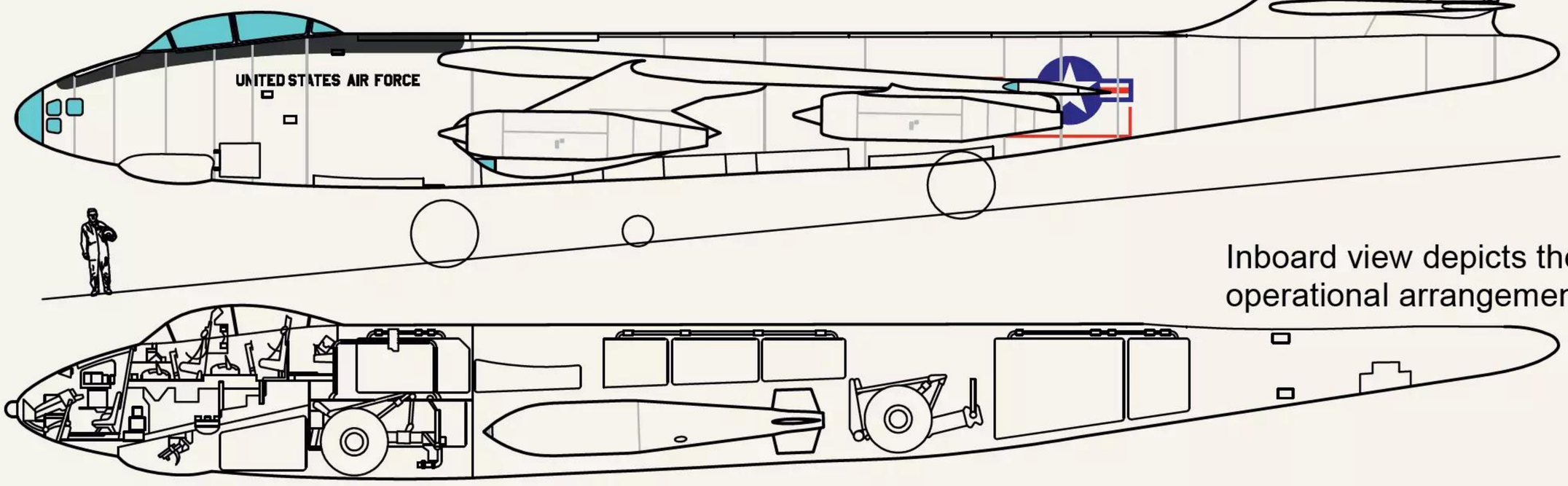


Inboard view depicts theoretical operational arrangement

Boeing B-47B

SCALE 1/200

0 5 10 M

0 10 20 30 Ft

USAF

MiG 15
to scale

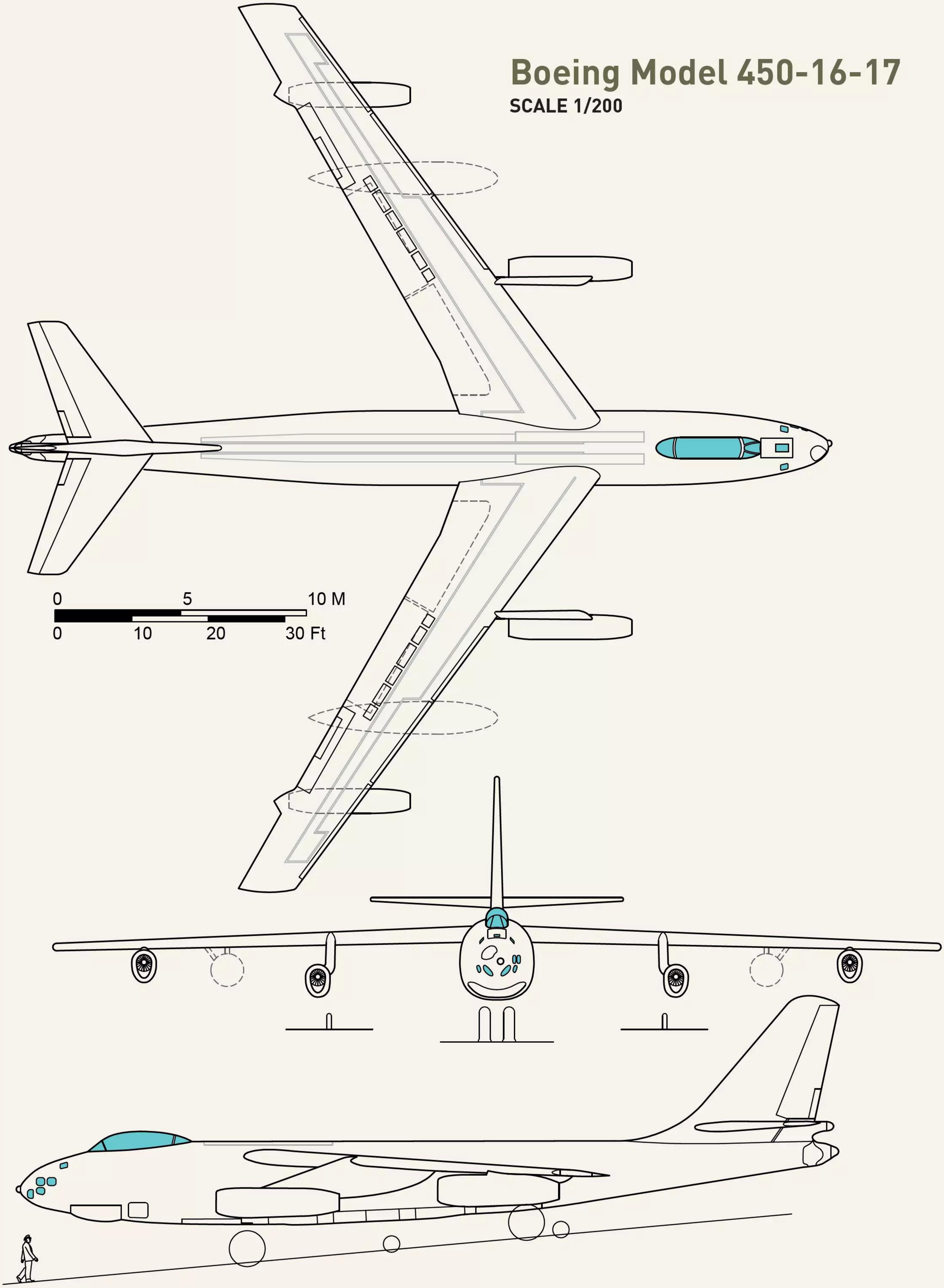
12363

UNITED STATES AIR FORCE

UNITED STATES AIR FORCE

Boeing Model 450-16-17

SCALE 1/200



early 1955, the A-5 was introduced onto new-build B-47s and was retrofitted onto existing airframes.

One change was unpopular with the crew: in order to save weight, the ejector seats were removed. In the event of a catastrophe in flight, the crew would be obliged to bail out. A spoiler was added to the crew door on the lower lefthand side of the forward fuselage in the hopes that it would give the crew a chance of gaining some distance from the fuselage before the airstream took hold of them.

An important improvement was the addition of an inflight refuelling receptacle to the right side of the nose. A door would open to provide access, allowing the aircraft to take on fuel and vastly increase its range.

The B-47B was used to test the liquid rocket system as an alternative to the JATO bottles for takeoff. For propellants the Aerojet YLR45-AJ-1 engines – two on each side of the plane, deployed outwards 20° for takeoff and stored within the fuselage afterwards – used white fuming nitric acid oxidizer and JP-4 fuel. This resulted in long, bright flames but no appreciable smoke. This was both good and bad: the lack of smoke made things a lot easier for any aircraft in line to take off behind the B-47, but the radiant heat from the bright exhaust torches did the skin of the rear fuselage no favours. Tests carried out from 1952 through 1954 showed that the added thrust (5,000lb per engine) certainly reduced the takeoff roll, but added complexity, cost and even weight to the aircraft. Given the risks of fire and explosion from the propellants, especially the corrosive WFNA oxidizer which had a tendency to blow up if not treated with great care around organic contaminants, the liquid rocket system was abandoned.

The first 298 B-47Bs were fitted with the General Electric J47-GE-23 engine, capable of 5,910lb of static thrust. The later B-47Bs were given General Electric J47-GE-25 engines which produced 5,910lb of static thrust.

B-47C

No 'C' model of the B-47 was ever built, but that was not for lack of trying. The idea kicked around for a while and gained some traction to replace the six rather disappointing turbojets that equipped the early B-47s with four more powerful engines. Initially the aircraft would be seemingly little more than a re-engined B-47, but it evolved into something else… something that pointed the way towards the future.

Boeing Model 450-16-17

In early 1949, Boeing produced Models 450-11-17 and 450-16-17. These were essentially the same design but with different engines: the former had four General Electric TE-TG-190-C11 engines (aka J47), while the latter had four of the more powerful Westinghouse J40-WE-6 turbojets. The latter, with substantially greater thrust (7,500lb to 5,610lb, military rating), seems to have received more study. However, while the J40 promised greater thrust, speed, altitude and range than the J47, the J47 had the benefit of actually working. The J40 turned out to be a protracted development nightmare, ultimately failing to produce a reliable production jet engine, and helping to usher Westinghouse out of the turbojet business.

The Model 450-16-17 had the round-ended vertical stabilizer of the B-47A and the asymmetrical nose of the B-47A. The engines were arranged as normal for the B-47, though the inboard pylons only had a single engine. The engine was offset to the outboard side of the pylon; this was done so that the outrigger stabilizing gear could fold up into the pylon itself rather than into an additional fairing built onto the engine nacelle. The diagrams show that the fuselage had the long bomb bay initially designed for the B-47 aircraft.

Boeing YB-56 (Model 450-24-26)

The same basic design was revisited in January 1950 and dubbed the B-47C. The J40 engines were this time replaced with Allison J35-A-23 engines. These promised yet more thrust (9,700lb with afterburners; 8,200lb normal rating), and so initially looked very promising. As of early March 1950, first flight was projected for April 1951. Also at this time, the configuration change was felt to be important enough to merit a new aircraft designation, the YB-56.

The YB-56 was to be essentially a B-47B with four engines arranged much as they were on the Model 450-16-17. In May 1950, contracts were drawn up to carry out the detailed design work as well as mockup construction of the YB-56. A B-47B was diverted from the assembly line for modification to the new configuration.

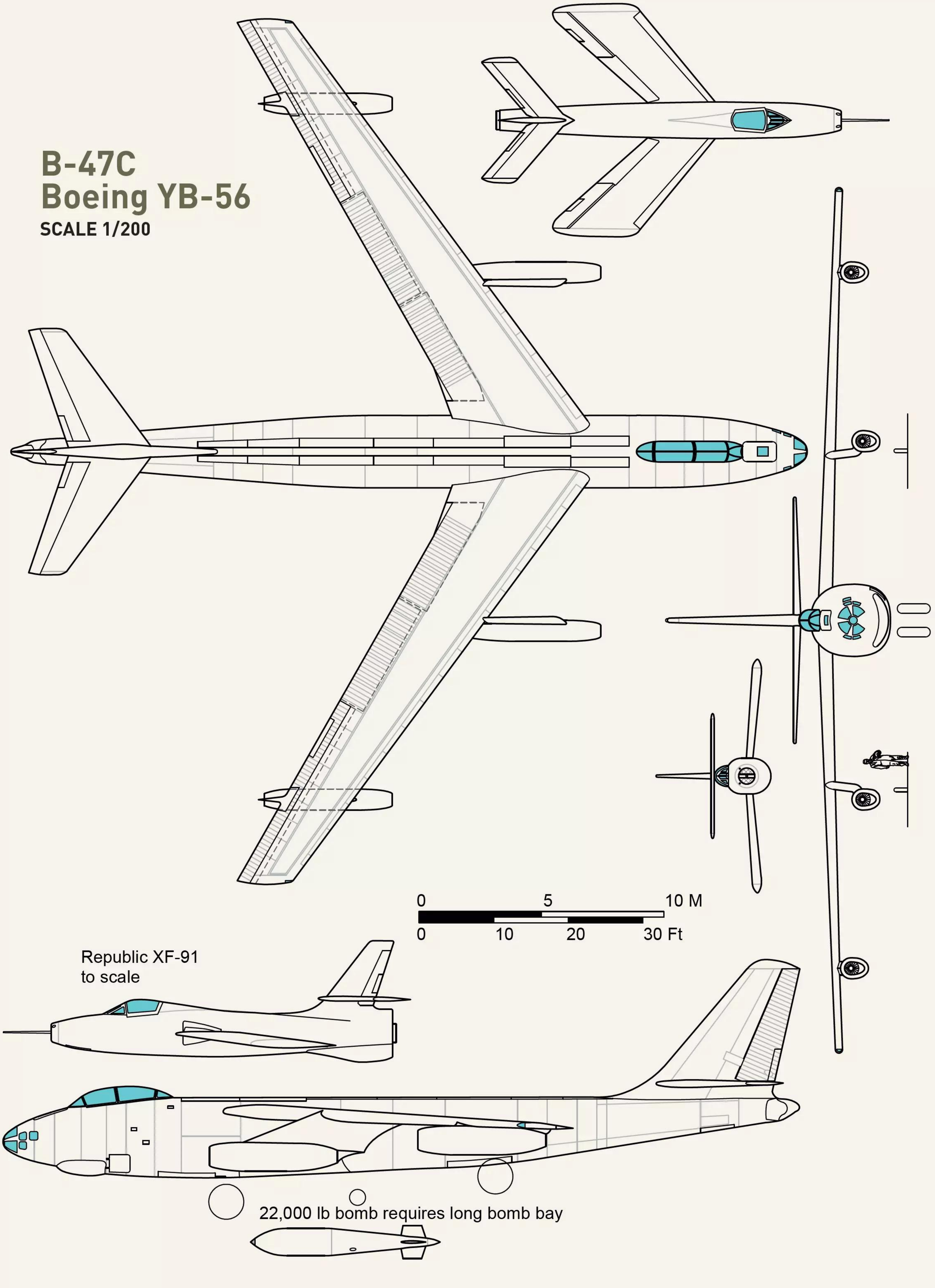
On August 14, 1950, the Air Force contracted Boeing to build 266 B-47Bs, 175 B-47Cs (the 'B-56' designation lasted only a few months before the Air Force changed its mind and went back to 'B-47C') and 35 RB-47Cs, definitely indicating interest in the design. However, on the following day the contract was changed to 294 B-47Bs, 21 B-47Cs and 86 RB-47Cs. And then on December 27 the contract was changed again to 445 B-47Bs, 19 RB-47C and zero B-47Cs. Once again, the contract was changed on April 12, 1951, to 471 B-47Bs, 48 RB-47Bs and 19 RB-47Cs. This was the end of the B-56 version of the B-47C, as it was cancelled in December 1952.

Boeing Model 450-155-33 YB-47C/ B-47X

In mid-March 1952, Boeing began work on a different version of the B-47C. Using the same engine layout as the prior iteration of the B-47C, it was intended from the beginning to use a different engine. As was the way of things at the time, the J35 engines had teething difficulties, reaching a maximum thrust not of 9,700lb but of 7,400lb. Consequently, other engines were planned.

B-47C
Boeing YB-56

SCALE 1/200

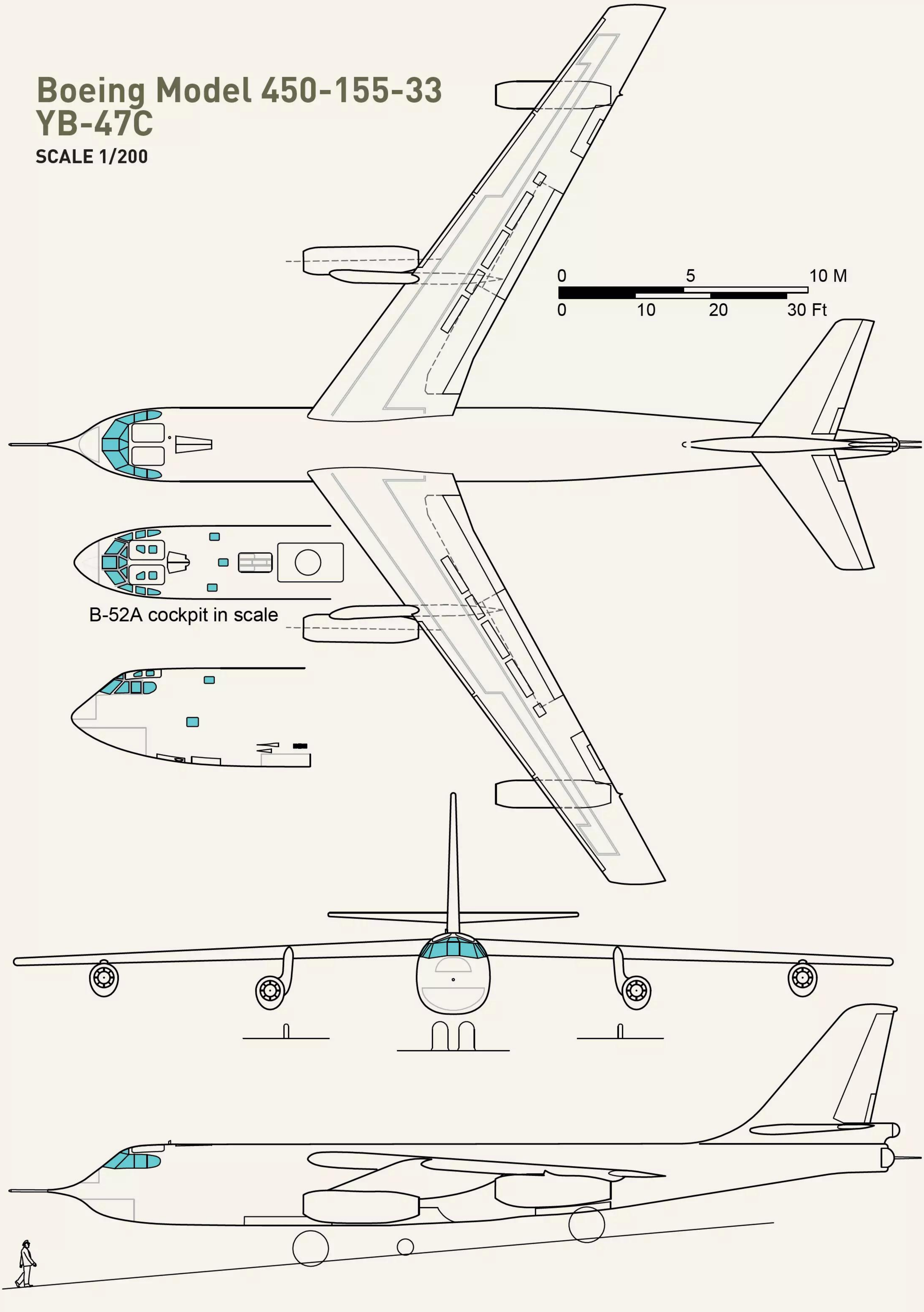


Republic XF-91
to scale

22,000 lb bomb requires long bomb bay

Boeing Model 450-155-33
YB-47C

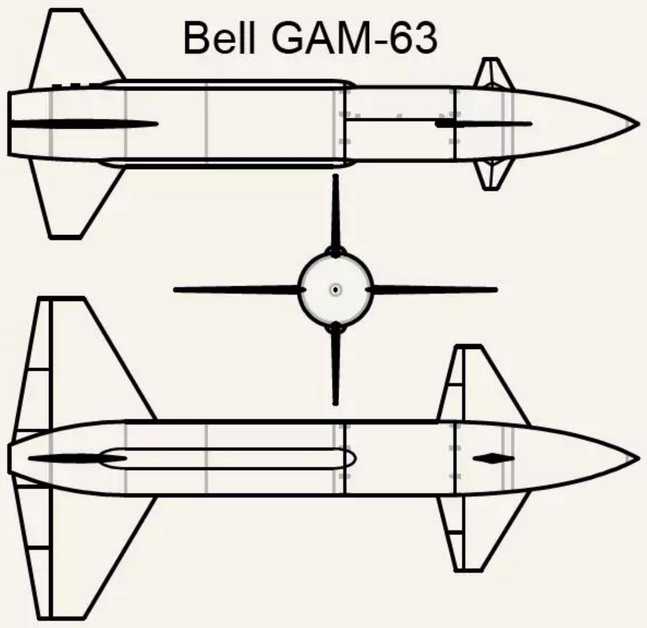
SCALE 1/200

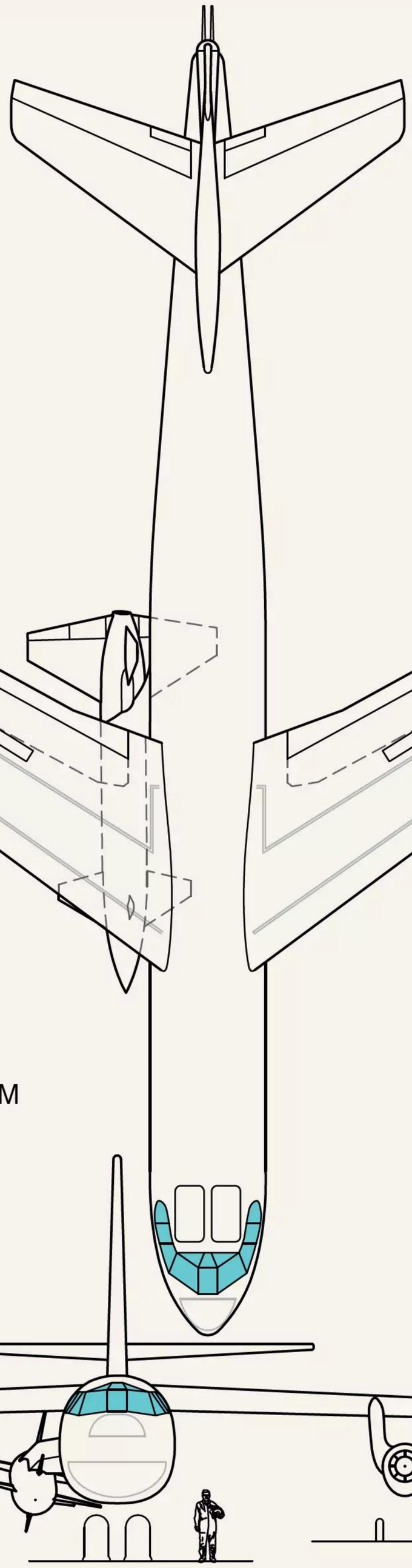


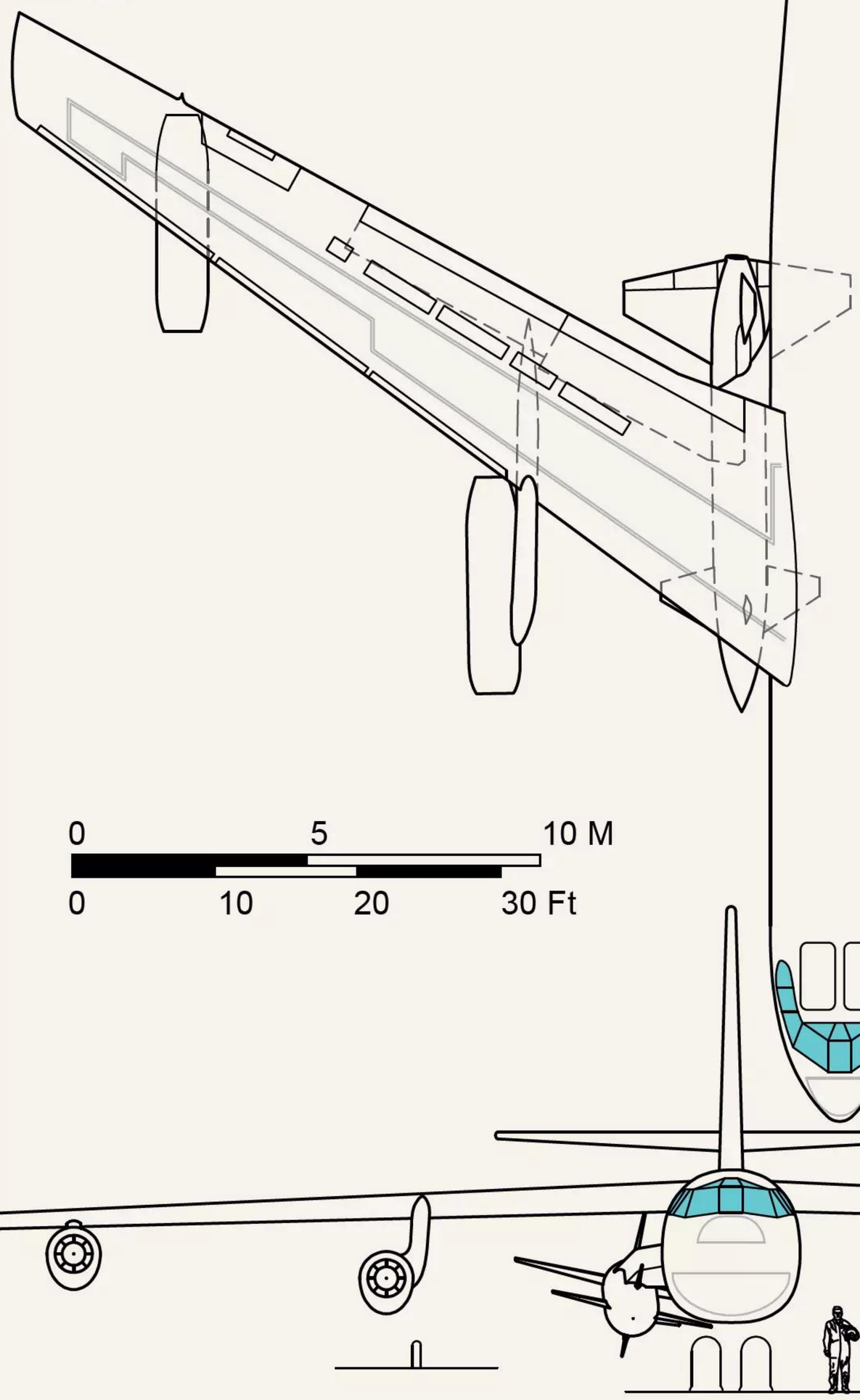
Boeing B-47C
Boeing B-47X

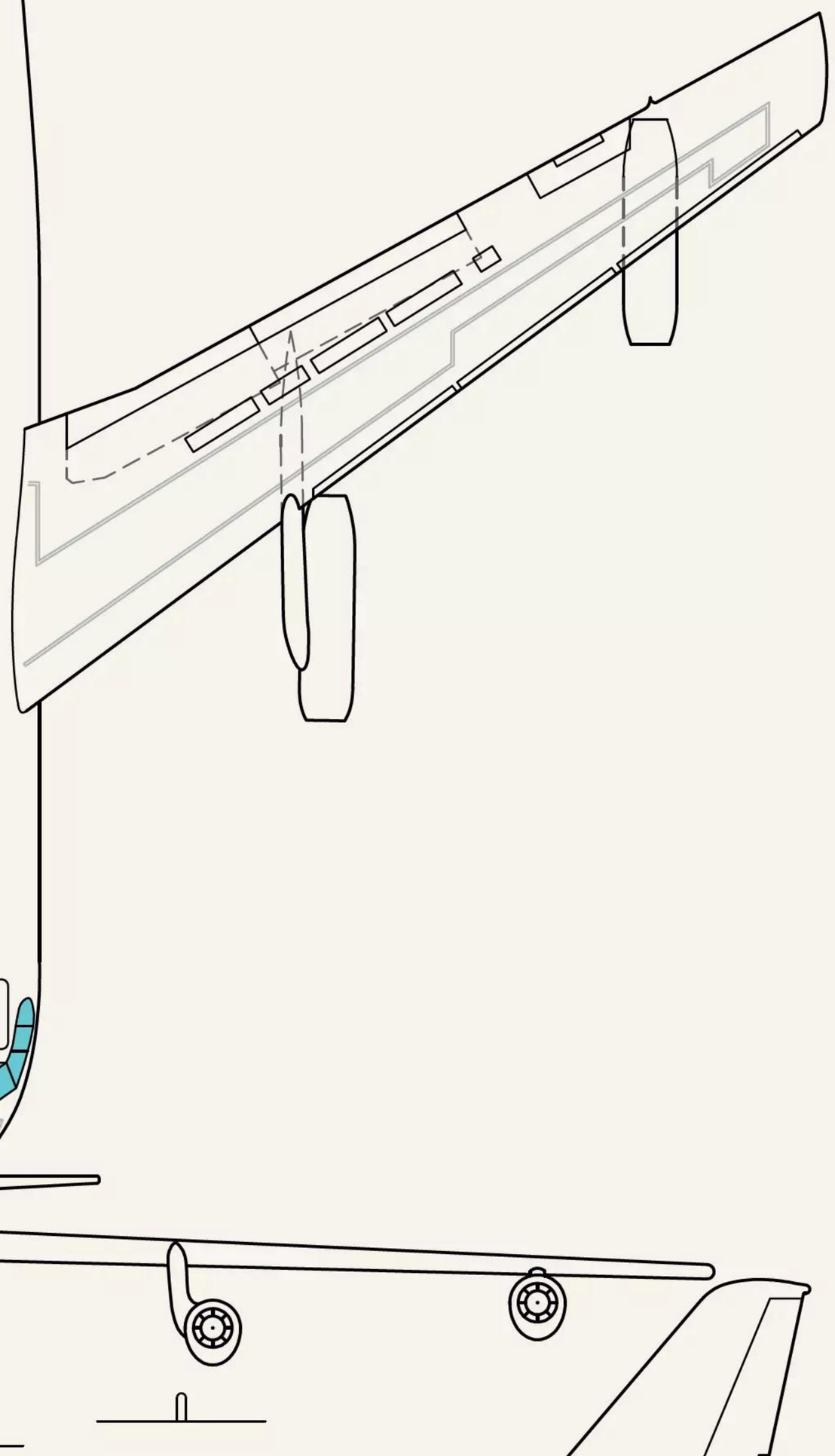
SCALE 1/200

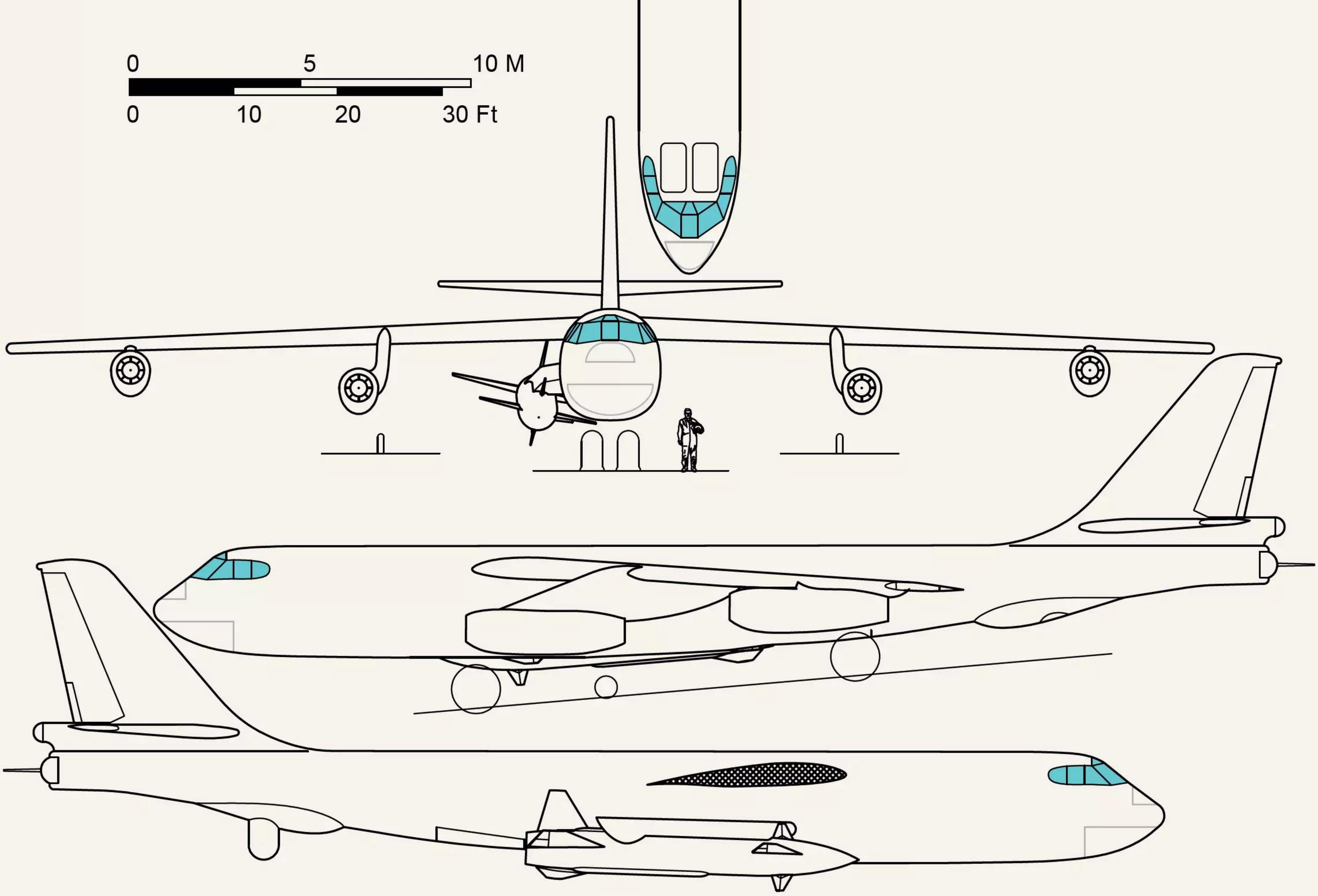
Provisional Reconstruction B-47X
Based on DB-47E and B-47C











The initial thought was to use the Allison J71-A-5, capable of around 10,000lb of thrust. The J71 was itself undergoing development troubles and was removed from consideration; it was replaced with the Pratt & Whitney J57. But the J57 was scheduled for use on the B-52, and by this point the B-52 was beginning to look like the next big thing. J57s were prioritized to the B-52 and could not be spared for the B-47C project.

The chord of the wings was broadened somewhat by pulling the trailing edge back slightly, modestly increasing wing area. But more obvious than the engines and the wing was a change in the fuselage. This aircraft variously and somewhat confusingly referred to as both the B-47C and the B-47X had an entirely new forward fuselage. SAC commanding General Curtis LeMay, it seems, disliked the tandem seating of the crew in the B-47, so he wanted to see a design with side-by-side seating. Thus the new B-47C had an entirely new forward fuselage and cockpit. This looked utterly unlike the B-47… but it did look like something that would come a bit later: the B-52. Just as he had disliked tandem crew seating in the B-47, he didn't like it any better in the XB-52 (or the YB-52). So when he ordered Boeing to redesign the B-52's cockpit, they already had a layout, ready to incorporate.

The B-47C forward fuselage as designed at this stage was a dead ringer for the B-52, just slightly smaller in depth and with a test flight pitot probe designed onto the nose. The crew of four (pilot, co-pilot, navigator-gunner and bombardier-assistant navigator) all sat in the forward fuselage and all were given ejector seats. The pilots sat up top, side-by-side behind the wide canopy; the navigators sat below and behind the radar, again side-by-side.

With this cockpit arrangement and the new, more capable J57 engines, Boeing designers had come up with an aircraft that should have impressed. And apparently it did: it impressed LeMay enough that he saw it as potentially competing with the B-52. Consequently, he disliked it. And LeMay disliking it killed the project.

Boeing B-47X/Rascal

The B-47X was described as being meant to carry the GAM-63 RASCAL standoff missile. Described further in the DB-47E section, this was a relatively large liquid fuelled missile that hung off the side of the aircraft in a rather ponderous fashion. No diagrams are currently available depicting this, so the reconstruction here is pieced together from the B-47C and DB-47E diagrams. It is provisional, but probably reasonably accurate. No weight or performance data is available. Given the considerable difficulties that the GAM-63 had, it is unlikely under any conceivable set of circumstances that the B-47X would have been built specifically to carry the missile.

Boeing Model 450-166-38

Dating from either the end of 1953 or early January 1954, Model 450-166-38 was perhaps the final design to try to incorporate four engines in the 'B-47C' pattern. The fuselage was essentially that of the B-47E; the four J57 engines were laid out as with the B-47C designs. The major change was a substantial increase in area of both the wings (33.5%) and the horizontal stabilizers (45%). The better engines and increase in wing area permitted a higher maximum ceiling, about a mile above the standard B-47E, as well as a combat radius increase of more than 1,100 nautical miles. Maximum speed was also substantially improved. However, this all came at the cost of increased dry weight and greatly increased maximum takeoff weight; this necessitated a structural strengthening of the landing gear.

For offense it could have either the short or long bomb bay, with a maximum load of 10,000lb; alternatively, it could carry a GAM-63 RASCAL missile externally. It retained the twin 20mm cannon in the tail with 700 rounds each.

B-47D

Turbojets gave the B-47 unprecedented speed for a bomber, far outpacing the best that its piston engined cousins could ever hope to achieve. However, early turbojets were fuel hogs, burning through propellant at astonishing – and range-discouraging – rates. But there was a compromise: the turboprop. A straight turbojet generates thrust by compressing and heating air by burning it with fuel, expelling the combustion products as a high velocity jet. But if that energy was used instead to provide the mechanical power to turn a propeller, the mass of air that would be pushed aftwards to generate thrust would be greatly increased. The average velocity of the air would be lower, but the mass flow rate higher. The end result is a notable increase in thrust and fuel economy, at the expense of a lowered top speed.

Another promising feature of turboprops over piston engines was the fact that the components of the turboprop rotate and don't reciprocate. The turbines simply spin, rather than banging back and forth like the pistons and valves in the earlier engines. This was expected to result in lower stresses, even with the high temperatures… producing engines that could operate much longer and more reliably. After all, the Convair B-36 was designed so that flight mechanics could access the massive radial engines in flight and perform some basic servicing. And turboprop engines did eventually surpass the piston engine in the area of reliability.

Boeing Model 450-9-3

Turboprop derivatives of the B-47 were under study before the aircraft even entered service. The first known of these

Boeing Model 450-155-38

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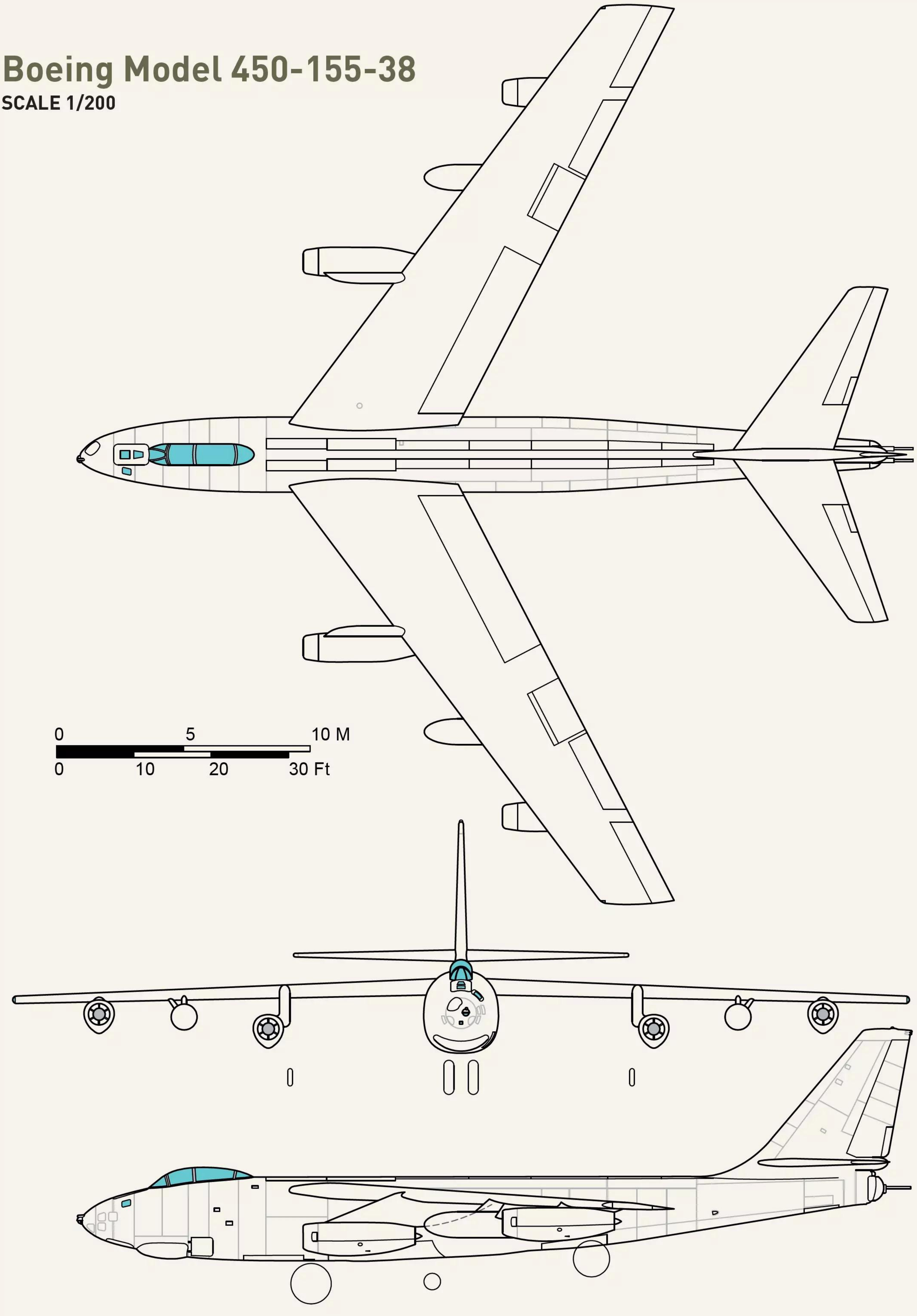

Boeing Model 450-9-3

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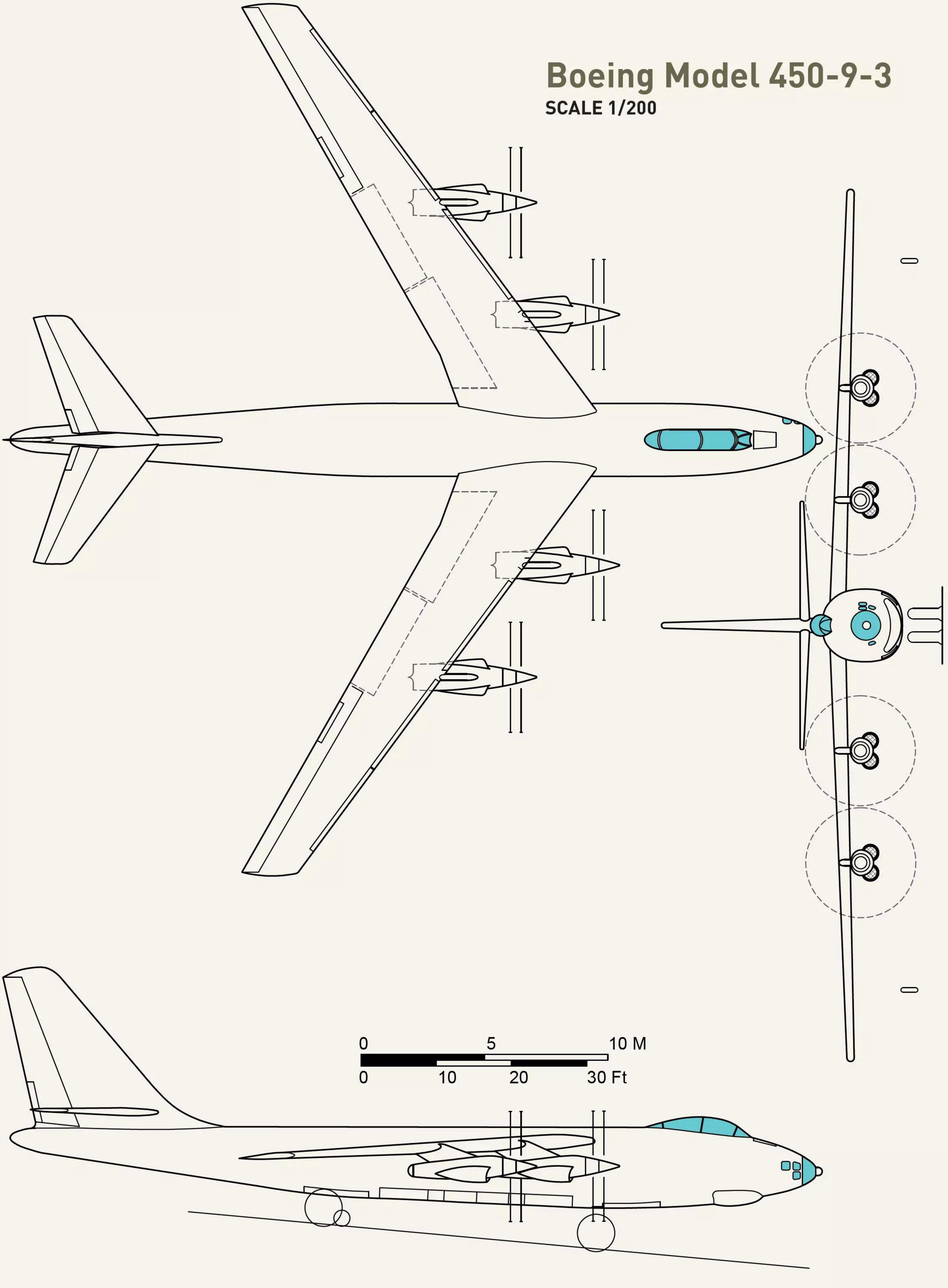

concepts was the Model 450-9-3 (dating from May 1948 at the latest), very much an XB-47 with the six turbojets replaced with four Allison Model 500 turboprops. Each turboprop engine was housed in a separate nacelle, suspended beneath the wings under short pylons (notably shorter than the pylons used to hang the B-47's inboard dual-jet nacelle… important for moving the propeller arc upwards and away from the runway).

The Allison Model 500 was given an official government designation as the T40. It was not actually a single powerplant but instead two Allison T38 turboprop engines attached side by side and connected through a gearbox to drive contra-rotating propellers. The T40 was used and proposed on a range of aircraft (it was the powerplant of choice on aircraft as diverse as the Douglas A2D Skyshark, Convair R3Y Tradewind, North American XA2J Super Savage and the VTOL tailsitters the Convair XFY and Lockheed XFV). But the development of the T40 was problematic and the gearbox was perpetually troublesome; no aircraft fitted with that complex engine ever entered mass production or saw real service.

While the T40 eventually failed, the T38 engines it was based on were further developed into the T56 (and then the Rolls-Royce T406), which has powered the C-130 Hercules for more than half a century.

The Boeing Model 450-9-3 was, depending on how you look at it, either a four-engine or eight-engine design. Either way, the nacelles were quite small, especially compared to the sort of space that would have been taken up with piston engines. The six-bladed propellers (three turning in each direction) would have been 15ft in diameter. Wing, fuselage and tail surfaces would have been essentially the same as the XB-47. Top speed at altitude would have been 510 miles per hour… substantially slower than the jet-powered B-47, but much faster than any piston engined bomber.

Boeing Model 450-30-10, Model 450-31-10

The Models 450-30-10 and 450-31-10 from February 1950, were part of a series of medium bomber potential growth studies. Covering design Models 450-25-10 through 450-64-10, these included both turbojet and turboprop variations on the B-47 theme, mixing and matching then-known powerplants in a wide range of configurations. Several are included here, though this is of course not an exhaustive list. These Boeing studies followed a 1949 RAND Corporation study which concluded that turboprop-equipped bombers were the best way to successfully penetrate deep into Soviet airspace. As often happens, a single report gained prominence for a moment and caused not only a stir of interest but a change in spending priorities.

Models 450-30-10 and 450-31-10 fitted a standard B-47B configuration with four T40 turboprops. The 450-30-10 tried something new with the location of the engines… instead of hanging below the wings in podded nacelles, here the Allison T40-A-8 engines were mounted above and ahead of the wings in long cylindrical nacelles that extended well past the trailing edge. The exhaust vented through two nozzles at the top of the nacelles just aft of the leading edges of the wings. Access to the engines for maintenance and replacement should have been fairly convenient as the engines were located ahead of the wings. Model 450-31-10 used a similar podded nacelle layout as the 450-9-3, looking much the same except for one difference. That difference, which the Model 450-30-10 shared, was a lack of contra-rotating propellers. Instead, both designs featured pointed and seemingly somewhat bulbous propeller hubs with four surprisingly small diameter (11ft) propellers. What these propellers lacked in number and diameter, though, they made up for in speed… the tip speeds of the propellers were meant to well exceed the speed of sound.

It should be noted that this engine was mated to supersonic propellers on the XGF-84H Thunderscreech. The name was well chosen; with a single T40 and a three-bladed supersonic propeller it achieved dubious fame as being probably the loudest aircraft in existence. While sitting motionless on the ground with the engine idling, shockwaves could be seen radiating away from the aircraft for a distance of some hundreds of feet. Nausea, headaches and seizures were reported among ground crew unfortunate enough to be anywhere near this aircraft. The idea of an aircraft fitted with four of these engines boggles the imagination; not only would it have turned the brains of ground crew into silly putty, low altitude overflights of foreign territory would likely have been met with charges of crimes against humanity. It seems fairly certain that the structure and skin of the B-47 would have suffered badly under the assault of constant volleys of sonic booms raining down onto it from the tips of the propellers.

Boeing Model 450-32-10 and Model 450-33-10

Boeing's speculations about turboprops with supersonic propellers did not end there. At the same time as the 450-30-10 and 450-31-10 (February 1950) were the 450-32-10 and 450-33-10. These differed in having Pratt & Whitney powerplants rather than Allison, and rather different powerplants they were. The -32-10 used the J57 turbojet (a fantastically successful turbojet, used for decades on aircraft such as the B-52 and KC-135) without major modifications to turn it into a turboprop; instead, aft of the engine in the turbojets exhaust was a separate mechanically unconnected 'free turbine' that was spun up by the exhaust gasses. The free turbine then spun the actual propeller. Unsurprisingly, this necessitated that the propeller be at the rear of the nacelle.

Boeing Model 450-30-10

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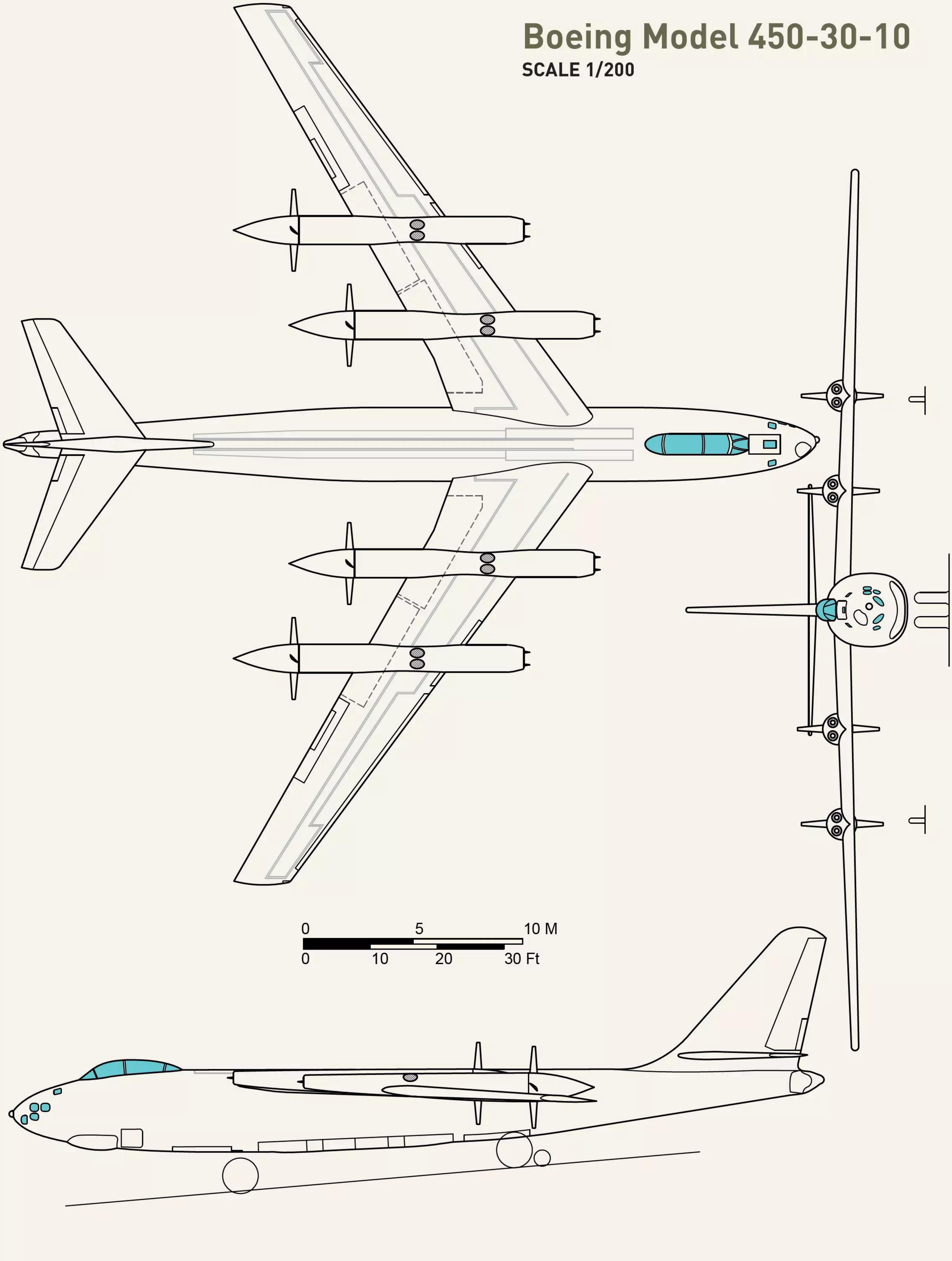

Boeing Model 450-31-10

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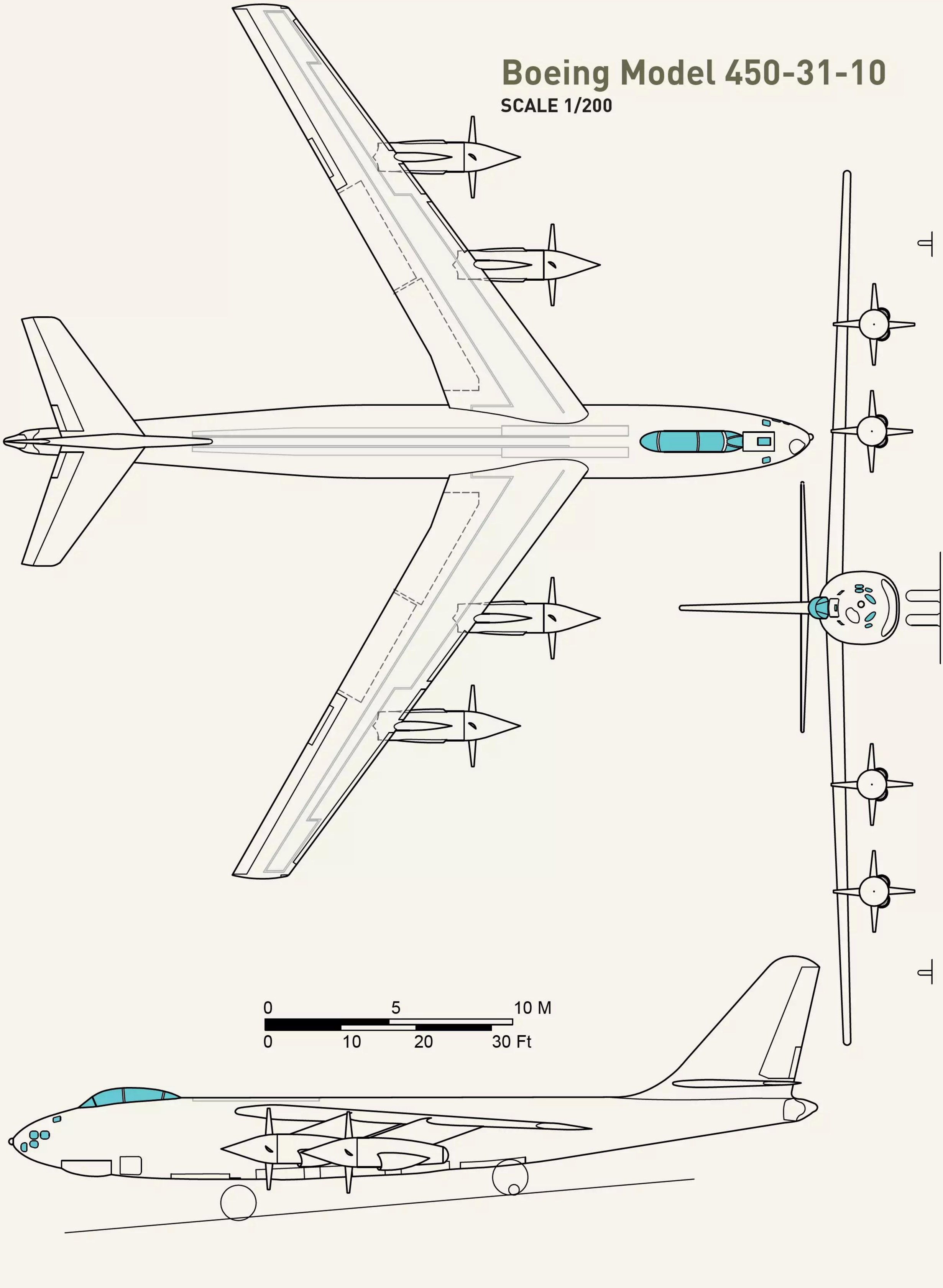

Boeing Model 450-32-10

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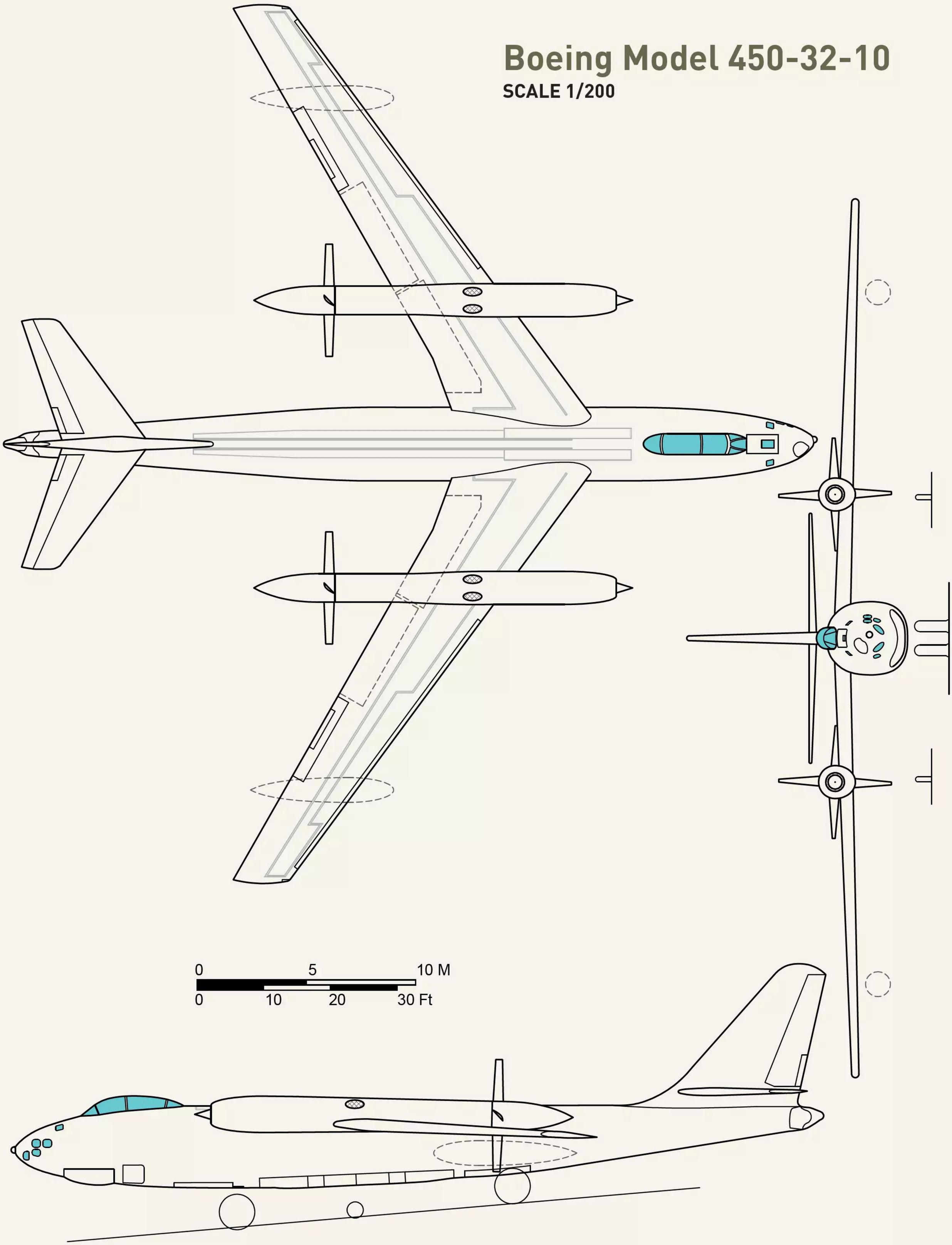

Boeing Model 450-33-10

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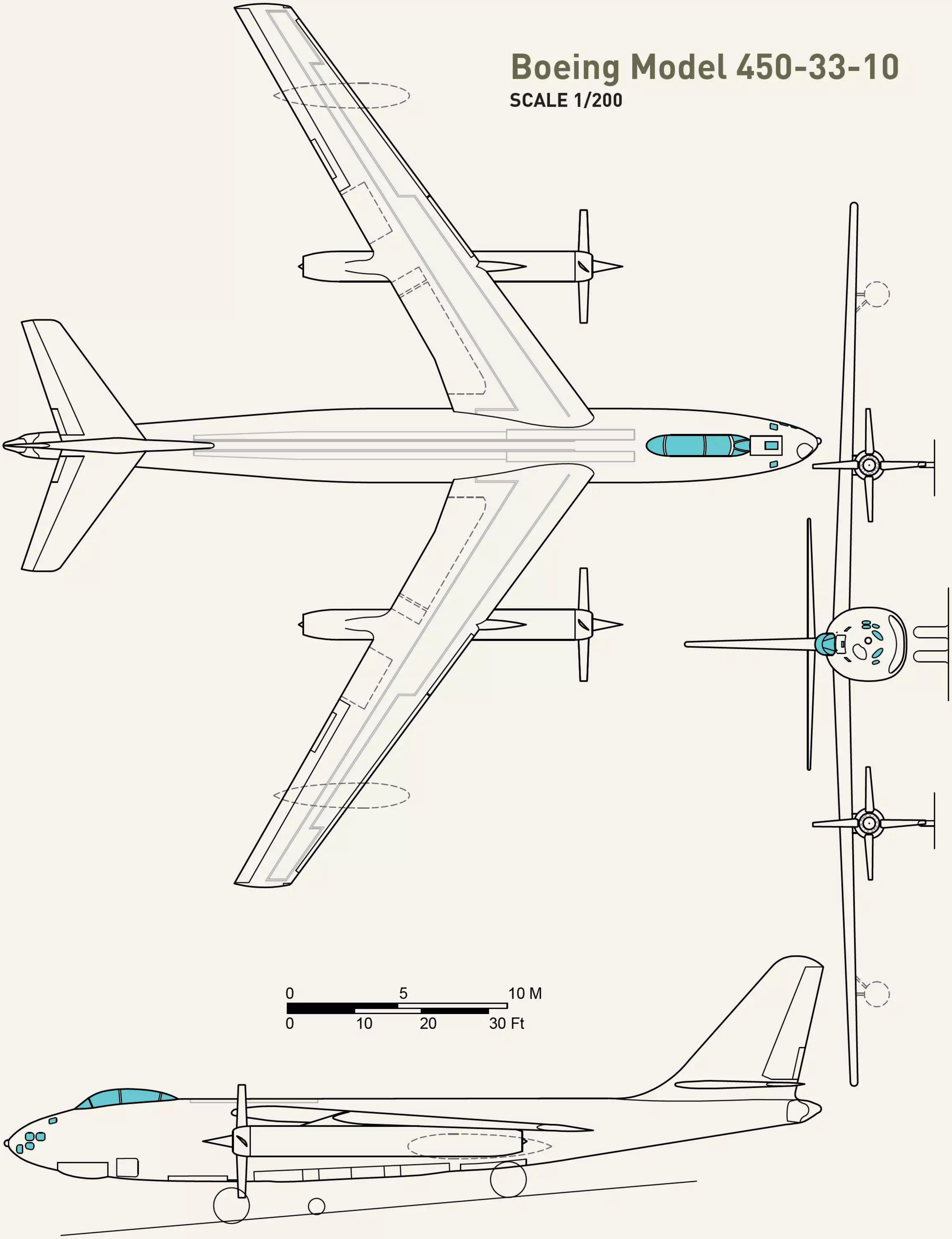

Once again, the engines themselves were mounted well ahead of the leading edge with twin exhausts on the upper side, just behind the leading edge, a long drive shaft connected to the pusher propellers behind the wing trailing edge. The -33-10 used a similar engine, the JT3A… the company designation for the J57. In this case, it appears that the engine was to be modified into a conventional turboprop. The J57 was a few years later so modified, producing the XT57 turboprop which was to power the unbuilt Douglas C-132 cargo plane; the XT57 turned out to be the most powerful turboprop ever built in the US. Whether that's exactly what the turboprop for the -33-10 would be is uncertain, but what is certain is that the 450-32-10 and the 450-33-10 would both have had 15ft diameter four bladed supersonic propellers.

The powerplants of the -32-10 and -33-10 would seem less capable than those of the -30-10 and the -31-10, given that there were only half as many J57/XT57 turboprops (two per plane) than there were XT40 turboprops (four per plane). But the XT40s produced around 5,500 shaft horsepower to the XT57's 15,000 shaft horsepower. With half as many engines the latter two aircraft would have had a third more power, but would have poured that power into what appear to have been virtually identical propellers. Extracting adequate thrust from those props doubtless would have proven to be an interesting and not least of all deafening experience.

Boeing Model 450-59-10

Model 450-59-10 of May 1950 returned to the earliest notion, with four podded Allison XT40 turboprops beneath the wings. This design in fact looks to be a warmed-over Model 450-9-3, just with a B-47B structure instead of an XB-47. Otherwise there is not much to distinguish them.

Boeing Model 450-60-10

The next design, Model 450-60-10 also of May 1950, tried yet another engine: four of the Pratt & Whitney PT-2E turboprops. These would be redesignated the Pratt & Whitney T34; the Douglas C-133 Cargomaster was their sole major use. They were roughly as powerful (5,700 shaft horsepower for the initial versions) as the T40, but without the complex linking of two separate turbojets. The result was a somewhat more conventional looking turboprop engine nacelle… the open-nosed prop spinner served as the engine inlet and the exhaust exited the nacelle at the rear.

XB-47D (Model 450-162-28)

The goal of a turboprop-equipped B-47 finally came to pass with the Model 450-162-28. Design work, which entailed the modification of the B-47B airframe to replace the inboard turbojet engine pylons with turboprops, began in 1950 and was completed in February 1951, with a contract issued shortly after in April. A mockup was completed by January 1952. Two incomplete B-47B were moved from the assembly line to a separate area for modification. Two Curtiss-Wright YT49-W-1 turboprop engines – derivatives of the J65 turbojet, itself taken from the Rolls-Royce Sapphire – were fitted into all-new nacelles and equipped with 15-foot diameter four bladed adjustable props. The undersides of the cylindrical nacelles were outfitted with sizable fairings into which the outrigger landing gear would stow. The outrigger gear now took on special importance: not just keeping the aircraft more or less level, but keeping the props from striking the ground. The outboard J47 turbojets stayed, unmodified.

First flight was projected for early 1953, but engine problems slowed progress enough so that the first of the two B-47Ds finally lifted off on August 26, 1955. The second B-47D flew on February 15, 1956, well behind schedule. The end result of all this was an aircraft that was very nearly as fast as the B-47B, but with much greater range: by that metric, a successful demonstration of the utility of turboprops for high-speed long-range bombers. But the downside was that as of the final B-47D flight in June 1956 the two airframes had only flown for about 50 hours total, and had demonstrated a need to overhaul either an engine or a propeller every 1.8 hours on average. Additionally, the B-47D exhibited some unfortunate flight characteristics such as engine out performance and porpoising while attempting to refuel from a KC-97. These difficulties, coupled with the rapid improvements in turbojets and inflight refuelling techniques, technologies and methodologies, led to the idea and the airframes being scrapped.

B-47E Model 450-157-35

The B-47E was the definitive version of the B-47; with 1,581 B-47E and RB-47E aircraft built, it was far and away the most-produced version of the plane. First flying in January 1953, early B-47Es were visually hard to distinguish from the B-47B. But soon the B-47E began to lose not only the windows around the nose but also the 18 RATO bottle ports on the rear fuselage. Even with General Electric J47-GE-25A engines with water injection and a maximum thrust of 7,200lb (which it could produce for only a brief period), the B-47E would struggle to lift off from shorter runways. It still needed the RATO assist, but the bottles were removed from the interior of the aircraft. Instead, they were increased in number to 33 and attached to a 'collar' that fit under the rear fuselage. The rockets would be fired in staggered order to spread out the thrust; after burnout – when the aircraft would hopefully be well airborne – the collar would be dropped, taking all its weight with it.

Boeing Model 450-59-10

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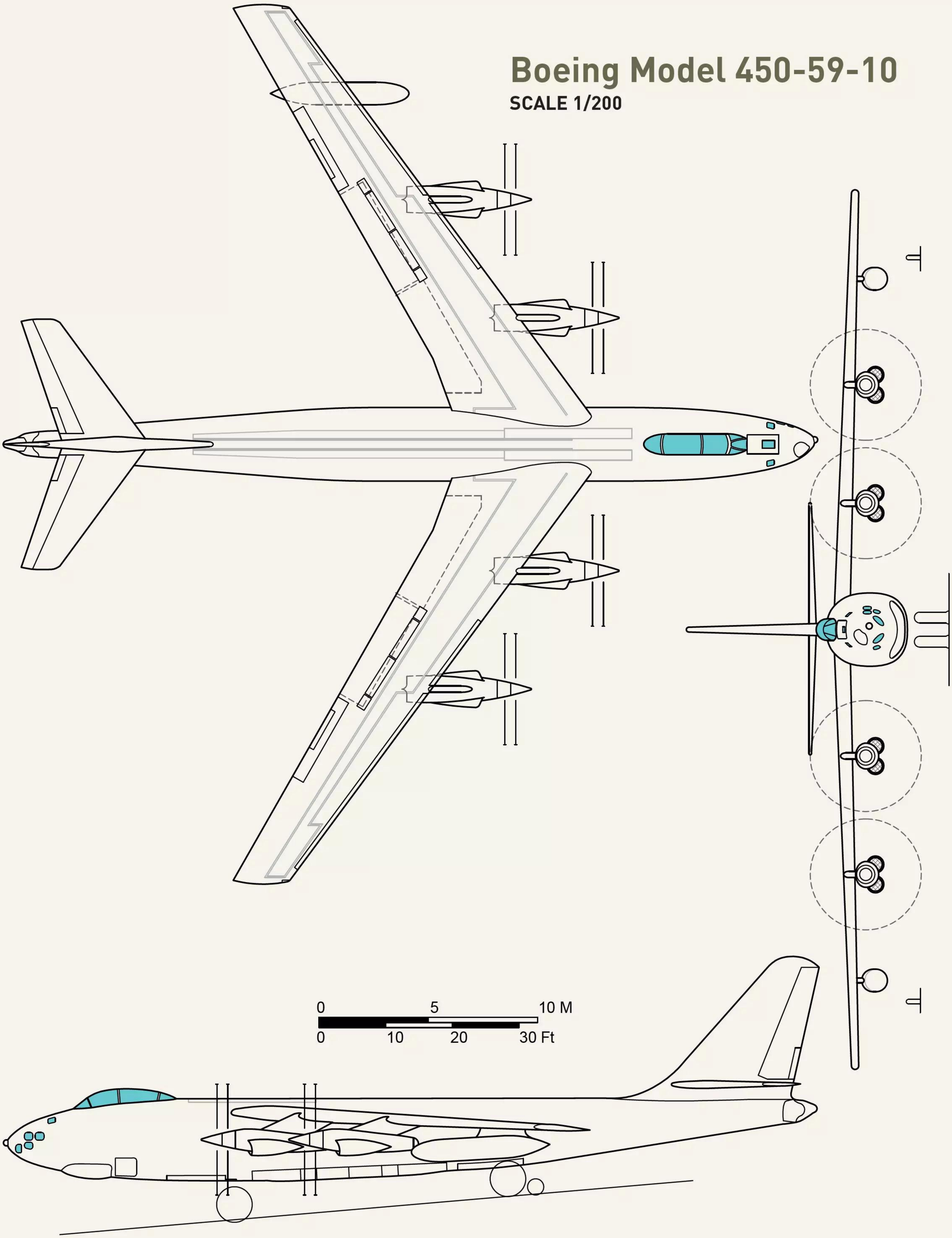

Boeing Model 450-60-10

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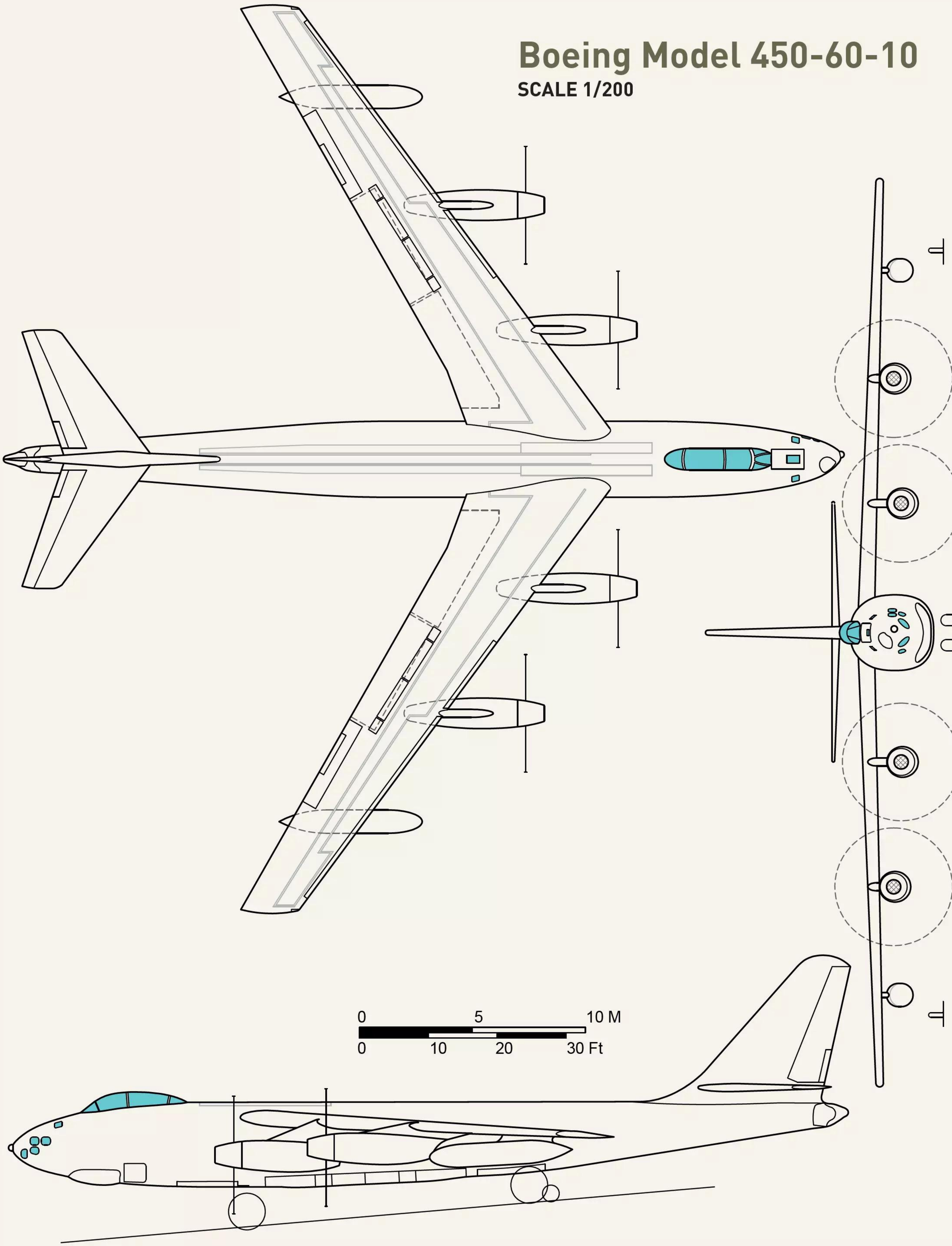

Boeing B-47D
Model 450-162-28

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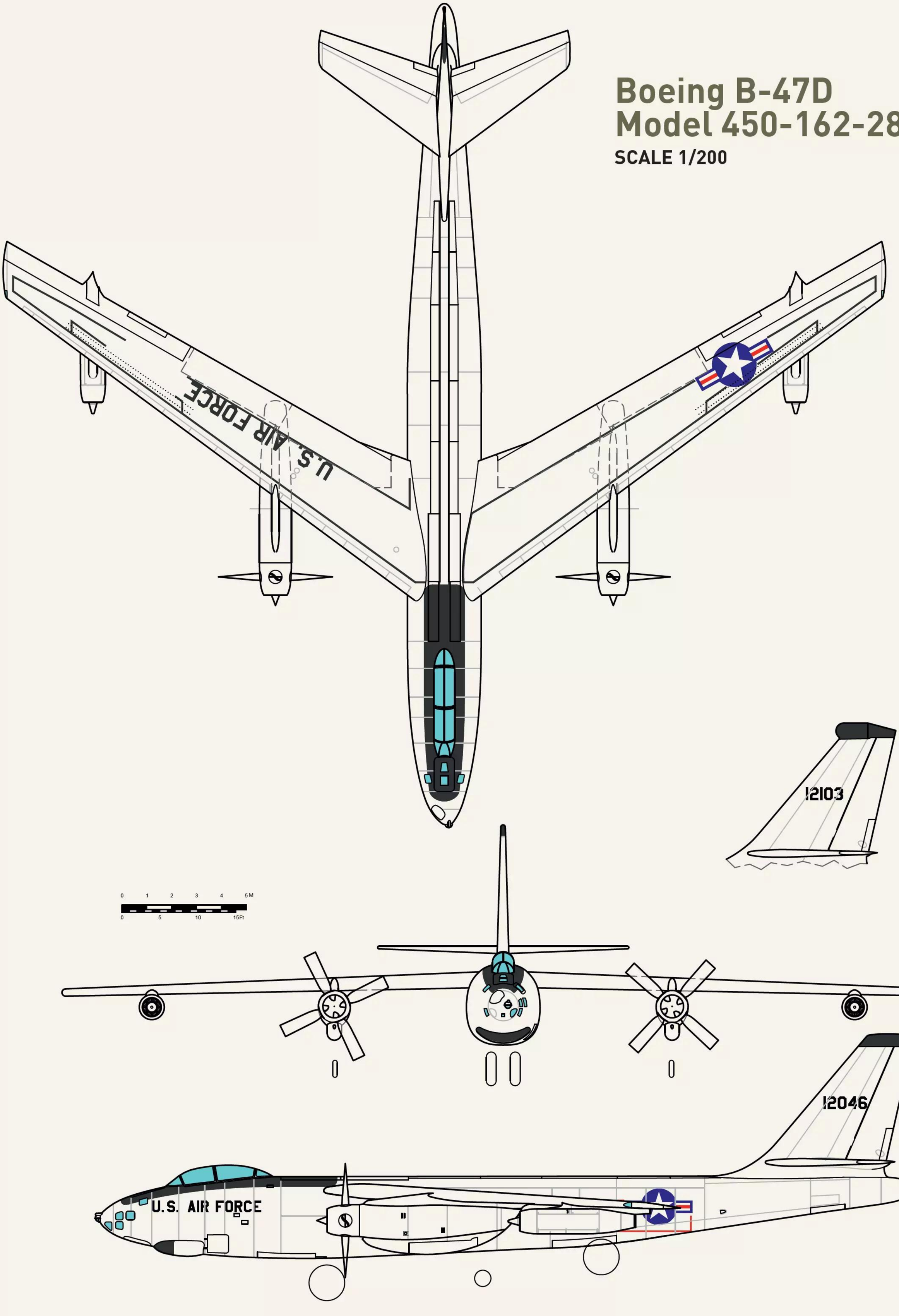

The ejection seats that had been taken away from the B-47B were returned for the B-47E, a change that doubtless was approved of highly by the crews. The pilot and co-pilot would eject upwards, while the bombardier/navigator would eject downwards. Downwards ejection is obviously not the preferred method; it's not a great solution at low altitude, and while the aircraft is on the ground, downwards ejection would end in a really bad day. But for most flight emergencies it would be far preferable to the more difficult and time-consuming process of bailing out through the side hatch.

It had been originally intended for the B-47 to fly at high altitude, evading interception with a combination of high speed and altitudes above what Soviet interceptors could quickly achieve. But it soon became apparent that the B-47 did not fly either high or fast enough. If it flew fast and low, though, it could evade detection by Soviet radar systems until it was too late. The problem with low level nuclear bombardment is that the bomber is not far from the bomb when it goes off. With the United States Air Force taking a generally negative view of mandating suicidal one-way missions, in 1955 another approach was worked out: the 'low altitude bombardment system' (LABS) where the B-47 flew low and fast, then suddenly pitched up and did a half roll. The aircraft was very quickly heading back the way it had come. But what made the process work was that while it was pitching up, it released the bomb at a specific point in the arc. The bomb was tossed high into the air to follow a ballistic arc; this gave the bomber time to get out of Dodge. Testing showed that bomb accuracy was good enough, given that the bombs were megaton yield. The LABS system was tested by B-47Es, with considerable study of how the aircraft structure responded to the stresses and strains imparted by the challenging manoeuvres.

The Air Force wanted the B-47E in large numbers, and was determined to get them. Boeing-Wichita, however, was not able to produce them as quickly as the Air Force would have liked, so Boeing's main competitors, Douglas and Lockheed, were brought on board to build B-47Es of their own. Boeing eventually produced 931 B-47Es and RB-47Es; Douglas made 274 in Tulsa, Oklahoma; Lockheed made 386 in Marietta, Georgia.

The most numerous of the major variants of the B-47E was the RB-47E strategic reconnaissance aircraft, of which some 240 were manufactured at Wichita. First flying in July 1953, the E-version was given a wide range of modifications, both permanent and modular. The nose was extended by almost 3ft to accommodate the specialist equipment needed by the camera operator, replacing the bombardier. The offset inflight refuelling receptacle was move to a position directly in front of the pilot's canopy. Curiously, the built-in 18-bottle RATO system used on the XB-47, B-47A and B-47B returned on the RB-47E. The bomb bay was filled with photographic equipment, with up to 11 cameras carried. It was a capable machine, but its production run was short (only 35 were built) and its service life was brief… the first operational B-47 of any kind to be retired was an RB-47E, sent to storage in October 1957.

In the end 255 RB-47Es were built, though the last 15 were finished as RB-45K aircraft specifically designed for weather reconnaissance.

RB-47H Model 450-171-51

Electronic countermeasures and intelligence were the specialties of the EB-47E and the RB-47H. The EB-47E was converted from the standard B-47E; several variants of the EB-47E were produced, but the main change was the addition of a pressurised capsule within the bomb bay. Two electronic warfare specialists occupied ejection seats of dubious effectiveness and operated the jamming systems that the aircraft was equipped with, and raised the crew complement to five. The EB-47E would fly at high altitude along with other B-47s as they penetrated enemy airspace; the EB-47Es would, through the use of chaff and multiple active radar jamming transmitters, blind enemy sensors to the bombers. The jammer aircraft themselves would of course be important targets. As Soviet surface-to-air missile technology improved, the survivability of high altitude subsonic bombers soon fell into serious doubt and the mission seems to have ended in 1964. Another version, the EB-47E 'Tell Two' was festooned with external antennae for the specific goal of intercepting telemetry data being emitted from the Soviet launch site Kapustin Yar and the Tyuratam Launch Complex. During missions one of the three EB-47E (TT) craft would fly at high altitude over either the Black Sea or northern Iran in order to intercept Soviet transmissions.

The RB-47H was an important departure. Thirty-five of these electronic countermeasure and reconnaissance planes were built by Boeing-Wichita, the first flying in June 1955. The RB-47H is most readily distinguished from the rest of the B-47s by the somewhat blunt black nose. This had the appearance of a radome, but in fact it was a fibreglass fairing protecting a bank of 18 antennae for the AN/APD-4 electronics intelligence system. This system automatically scanned through a range of radio frequencies, seeking out signals of interest. Once a signal was located, three onboard electronic warfare officers could examine it. They occupied a pressurised capsule in the bomb bay, a development of the capsule employed by the EB-47E. Numerous other receivers were located on the outer surface of the aircraft, most notably around the underside of the rear fuselage. These were all passive receivers. Other receivers were carried in pods hung under the wings or projecting from the sides of the fuselage.

Boeing B-47E

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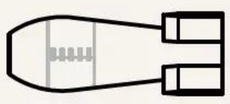
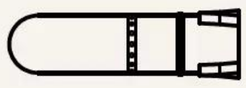
USAF

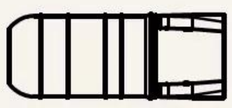
MK V Nuclear Bomb



MK 15 Thermonuclear Bomb



MK 36 Thermonuclear Bomb



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U.S. AIR FORCE

The RB-47H achieved two feats that it could boast of. Firstly, the aircraft directly overflew Soviet territory many times in the quest to obtain electronic intelligence. And secondly, the RB-47H was the last variant of the B-47 to remain in Air Force service. The role of bomber had been supplanted by the mighty B-52 and Soviet surface-to-air missiles made overflights of subsonic and relatively slow-flying aircraft such as the B-47 unsafe. So on December 29, 1967, an RB-47H departed for Davis-Monthan to enter storage. The day of the B-47 was over, just a few days over 20 years since the first XB-47 had taken to the skies. The replacement for the B-47, the Boeing B-52, stands a good chance of staying in service for nearly a century.

Derivatives

As with many successful aircraft, numerous modified versions of the aircraft were created beyond the normal variations of production runs. These include assorted reconnaissance and electronic warfare versions, which are largely outside of the scope of this book due to their being fairly well known. But some other models were a bit more unusual and interesting.

DB-47E/RASCAL

World War II saw the development and deployment of the first practical – or nearly so – air launched guided rocket weapons, as well as the first operational liquid propellant rockets. It was probably inevitable that shortly after the war a large long-range surface attack missile would be proposed. In April 1946 the Air Force approved the MX-776 programme, the goal of which was a large liquid-fuelled missile to be carried by a bomber such as the B-36. Initially designated the B-63, it was redesignated the GAM (Guided Air Missile)-63 RASCAL, a somewhat tortured acronym for RAdar SCAnning Link. The missile was meant to be guided in order to execute precise attacks, but the technology was not there for the missile to guide itself so a complex system was planned.

Prior to launch, the carrier aircraft would use onboard navigation systems to precisely locate itself so that it knew where it – and thus the missile – was in relation to the target. After launch, the missile would use an inertial tracking system to roughly locate itself. Final targeting was the unique aspect of the design. The missile was fitted with its own terrain scanning radar; as it approached the target it would relay an image of the terrain in the area of the target back to the launch aircraft. A missile operator would examine the image and compare it against known radar maps of the target area and relay back to the missile course corrections. The goal was a circular error probability of 500ft.

The RASCAL was test launched from the B-50 and B-36 bombers, but in 1951 it was determined that the B-47 would be the operational carrier aircraft. The RASCAL was a very large weapon to be carried by the B-47; at 4ft in diameter and 32ft long, there was no possibility of stuffing it into the bomb bay. So it was to be hung off the right side of the fuselage below the wing. Initially B-47B aircraft were planned, with required modifications turning them into DB-47Bs ('D' for 'Director'), but the B-47E was later found to be a better candidate. Thus both DB-47B and DB-47E aircraft were modified and flew with the GAM-63. Some thirty DB-47Bs were to be converted and six DB-47Es (two being a YDB-47Es and two being JDB-47Es).

The performance of the RASCAL was, by later standards, rather anaemic. It was not the sort of hypersonic ballistic missile that later decades came to recognise; instead, it was essentially a rocket powered airplane. At launch it weighed 18,000lb; thrust was provided by three Bell XLR67-BA-1 liquid propellant rocket engines. As each engine only produced 4,000lb of thrust, at ignition the thrust to weight of the missile was well under one: were it sat on its tail and fired vertically, it would simply sit there while it burned off propellant. It was held aloft not so much by the thrust of mighty rocket engines, but by lift produced by its substantial wings. After launch – normally at around 35,000ft – the RASCAL would climb to around 60,000ft. Maximum speed would be about Mach 2.95. Range was only 75 to 90 nautical miles; the last 20 of which would be in a shallow dive. In the event, if the missile could not be correctly launched, it could be dropped as a gravity bomb.

The purpose of the RASCAL was to give the crew some standoff distance from the target rather than to extend the performance of the B-47. A range of only 90 miles, at the cost of added weight and drag, actually reduced the B-47's reach. Worse… numerous test launches, and more numerous attempted but failed test launches, showed that the RASCAL was abysmal in reliability and dismal in accuracy. Much of this had to do with the stingy way in which the programme was funded, a result in no small part of Curtis LeMay's antipathy towards the programme. Finally, the programme was mercifully cancelled in late 1958, the DB-47s converted back to conventional bombers.

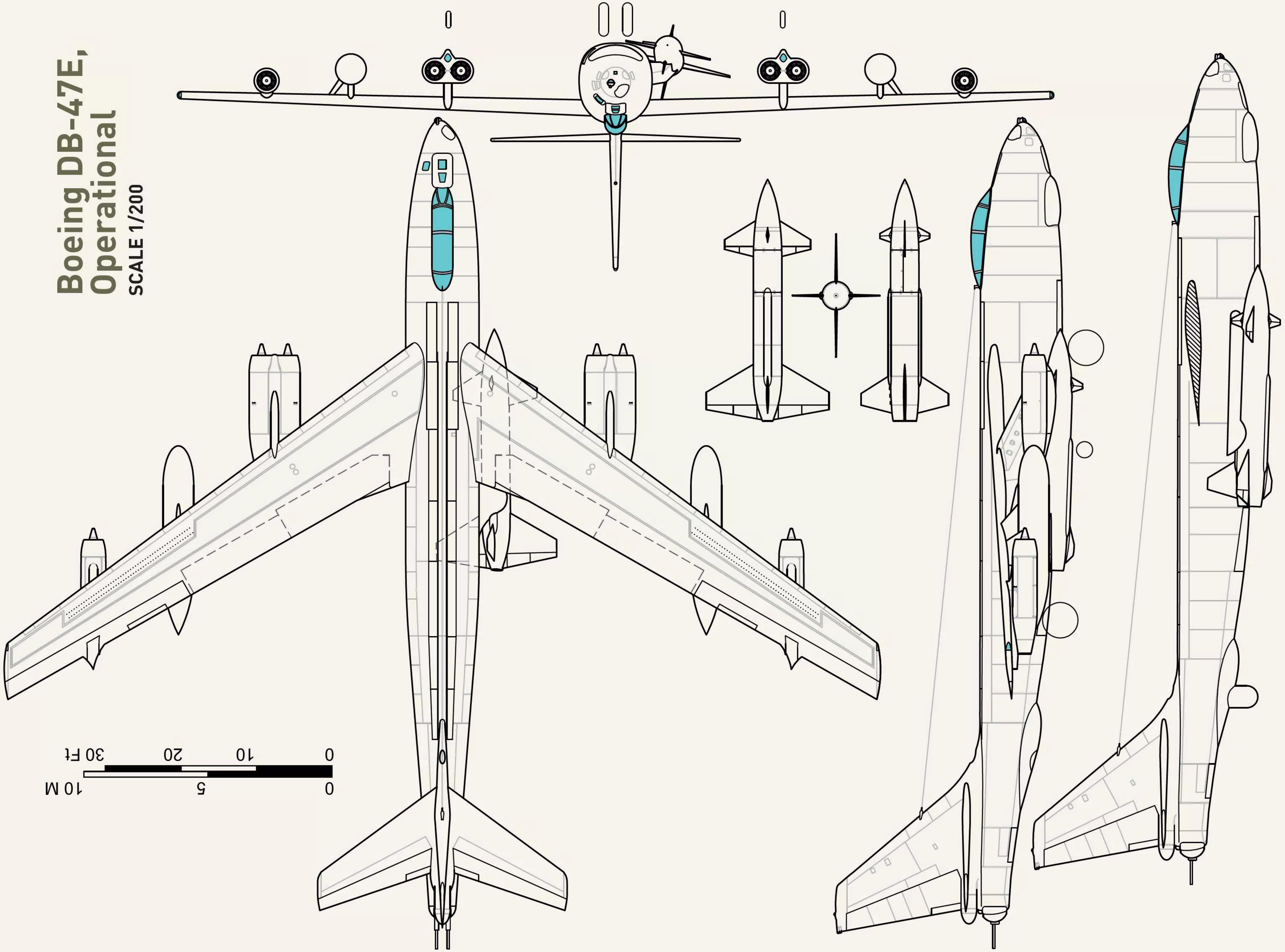
Bold Orion

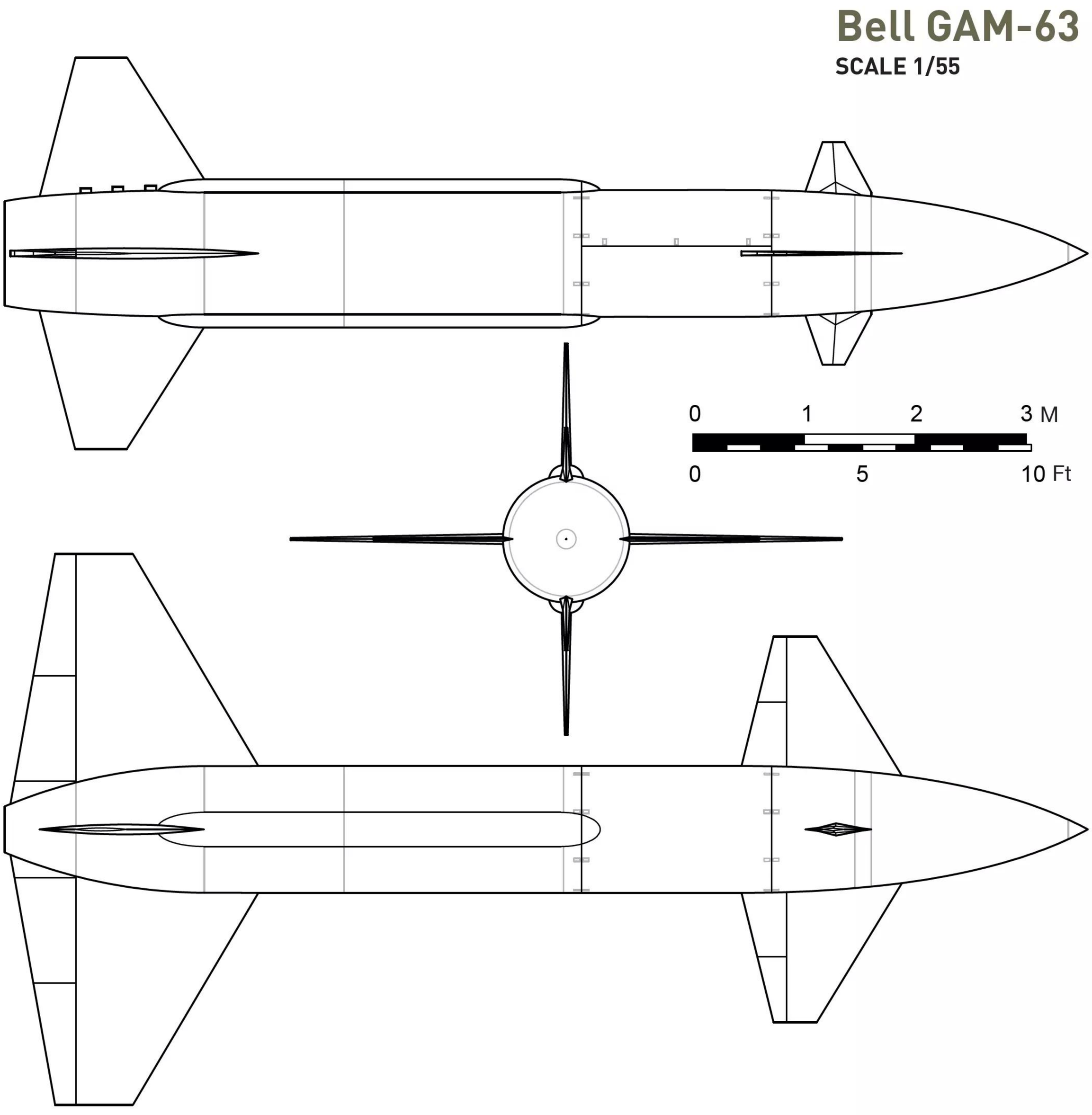
Better by far than the RASCAL was Bold Orion. It was in some ways the same idea… a large missile hung off the side of the B-47, in this case, one of the YDB-47Es (a JDB-47E was also used). But instead of a liquid rocket airplane, the Bold Orion was a solid fuel rocket – a true ballistic missile.

A Martin programme, the Bold Orion began in 1957 as Weapons System 199B. It was intended to be a technology demonstrator, rather than an operational vehicle; the

Boeing DB-47E, Operational

SCALE 1/200





Strategic Air Command had hopes for a larger missile to be carried by the B-52 but the technology was too new to leap right into an operational system. So existing components were used where possible. Initially it was a single stage vehicle using a Thiokol TX-20 Sergeant, but range was not as hoped so a second stage in the form of an Allegany Ballistics Laboratory 'Altair' was added. With two stages, the missile would attain a range in excess of 1,100 nautical miles.

The test flights of the Bold Orion were a mix of success and failure, with six rated as successes, six failures. The final launch, on October 13, 1959, was a bit different than the rest: after a climb to 35,000ft, the DB-47E launched the Bold Orion on a nearly vertical trajectory, sending it around 160 nautical miles up. It targeted the dead Explorer VI satellite, orbiting at 156 nautical miles and missing it by four miles. As an anti-satellite test this was deemed a success, as an operational anti-satellite system would have been equipped with a thermonuclear device which would have fried the satellite's electronics at that distance.

That is a point to ponder: the B-47 emerged from the depths of World War II, a war started with aircraft that in

Boeing DB-47E+
Bold Orion

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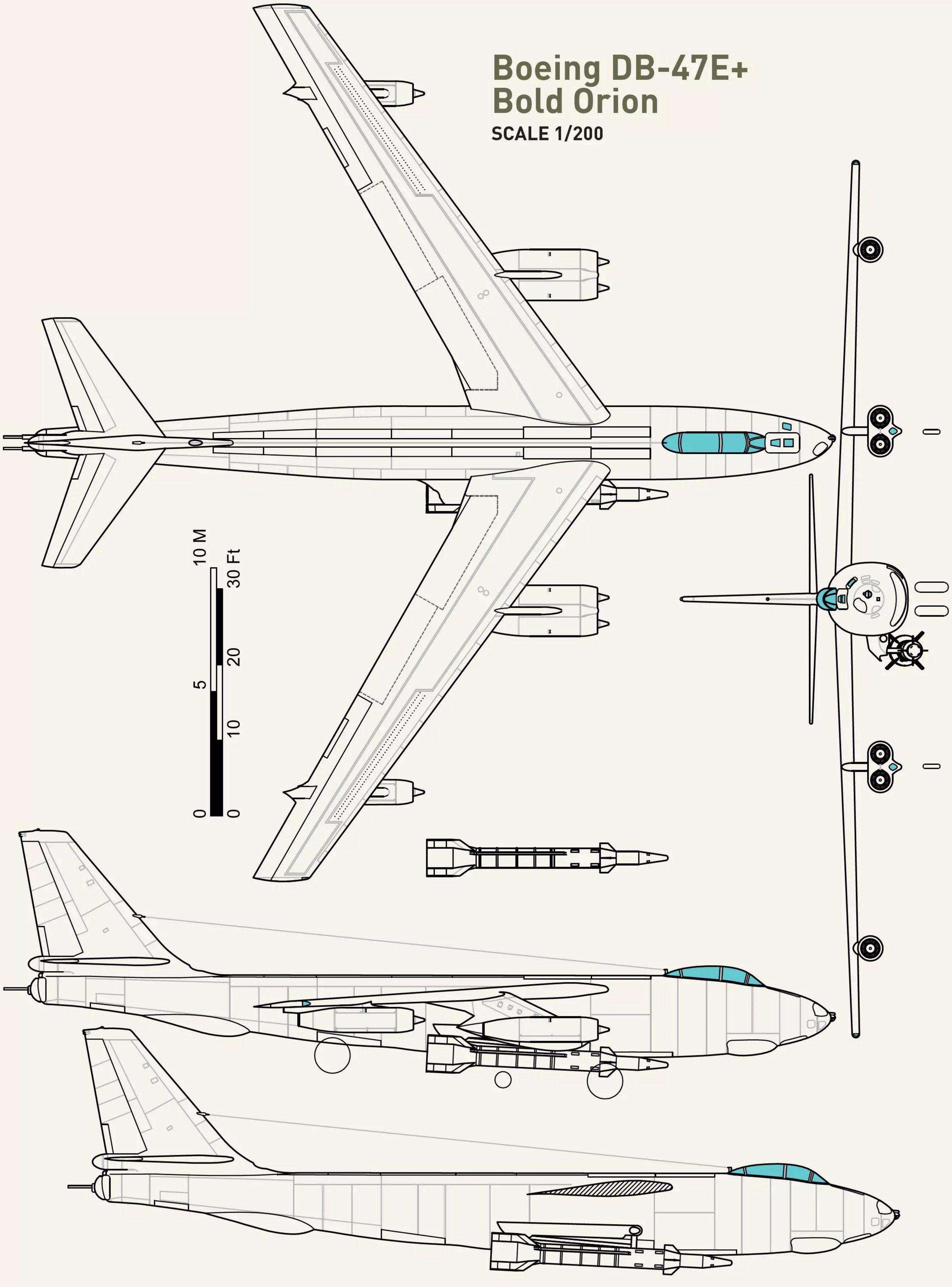
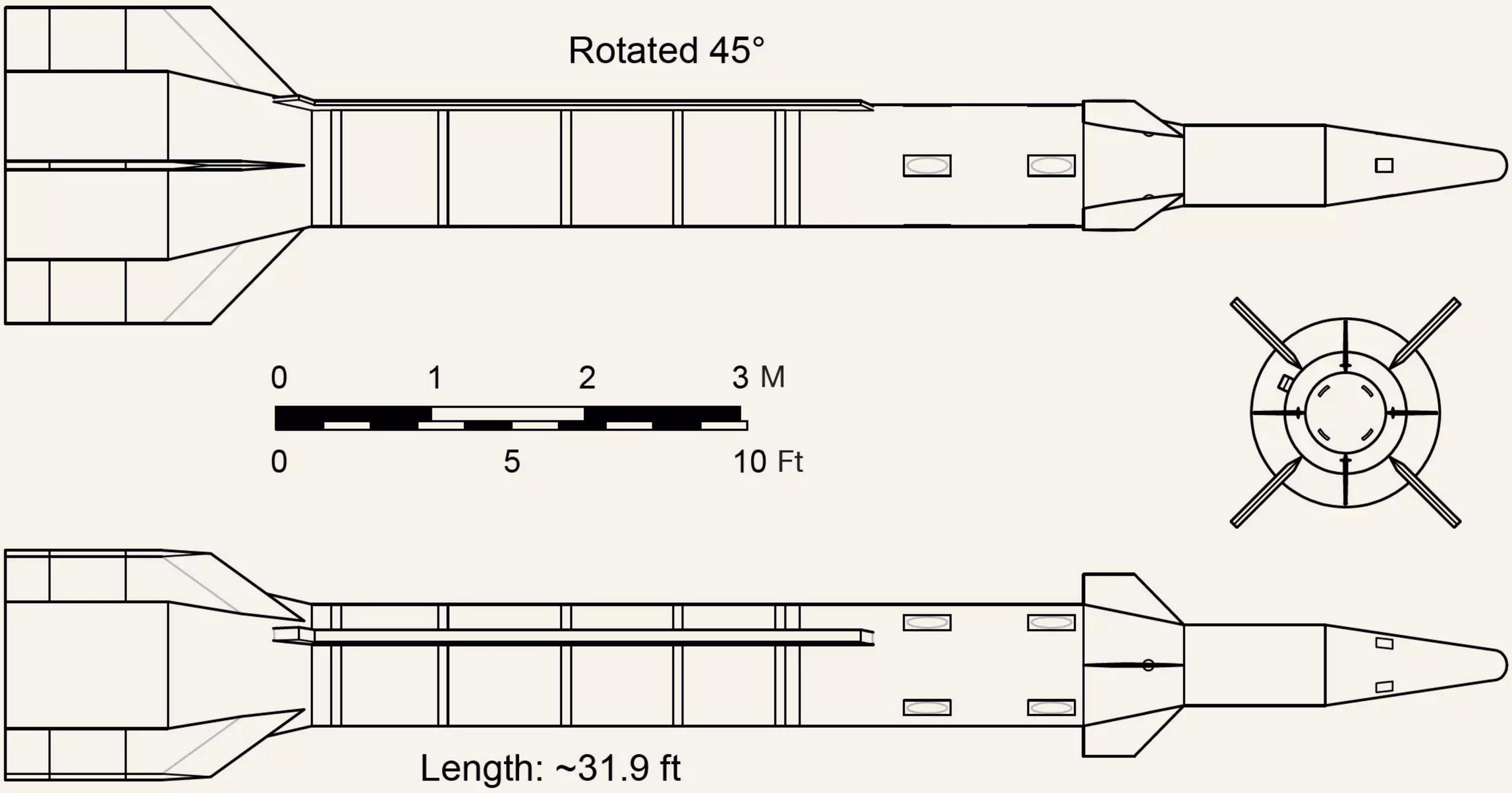


Bold Orion

SCALE 1/55

Rotated 45°



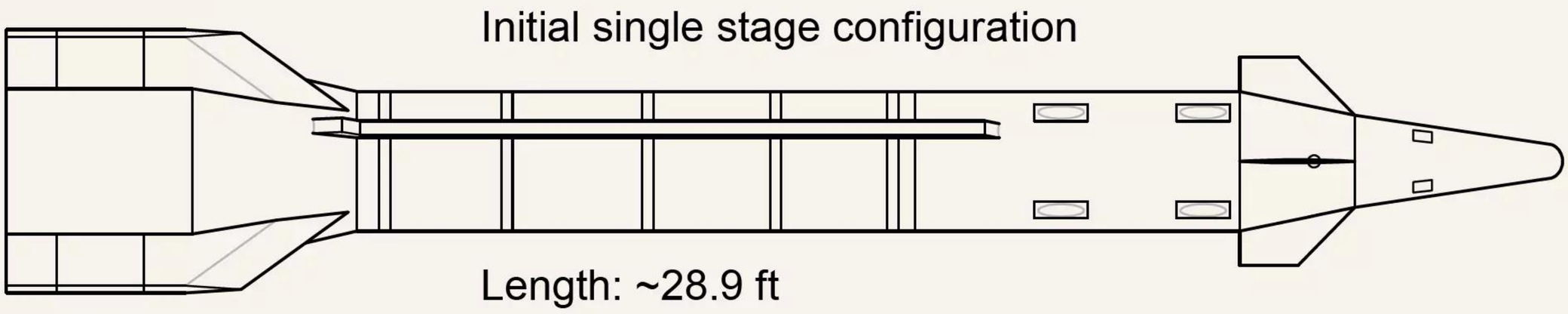
0 1 2 3 M

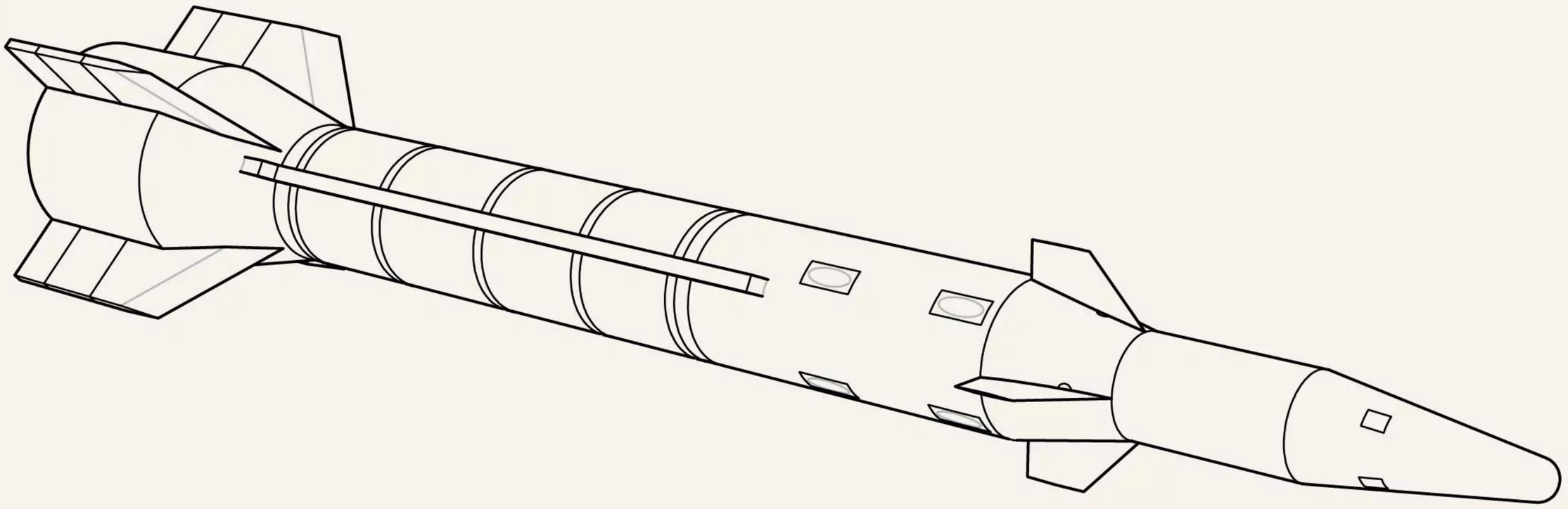
0 5 10 Ft

Length: ~31.9 ft

Initial single stage configuration

Length: ~28.9 ft





many cases thought they were doing pretty good to exceed 150mph and resulted in the B-47 which demonstrated the ability to shoot hydrogen bombs into outer space.

Crossbow

While the RASCAL and Bold Orion programmes were aimed at nuclear-armed strategic weapons, another programme tried to give the B-47 a tactical edge. The Radioplane GAM-67 Crossbow was a small subsonic turbojet powered unmanned aircraft; straight-winged, cylindrical fuselage with an underslung inlet, it looked like a primitive cruise missile… which was not far off. Originally designated the B-67, the Crossbow was intended to home in on Soviet radar transmitters, diving onto the target at nearly the speed of sound and setting off an unspecified conventional explosive.

Reportedly it was at one time suggested to install small nuclear warheads, a seemingly excessive approach for taking out radar installations. Two DB-47Es (unrelated to the DB-47Es used for RASCAL) were modified as carrier planes; each bomber had four pylons added (one between the inboard and outboard engines on each wing, and one remarkably large pylon between the inboard engines and the fuselage). Additionally, the bomb bays were filled with a manned capsule. Unfortunately, performance of the Crossbow fell short… the little airplanes were slower than intended and the range was too short… shorter than the radars they were meant to take out. This rendered their utility minimal, as the B-47 carrier aircraft would be detected and interceptors vectored in well before the Crossbows could take out the radar. The first successful flights occurred in mid-1956, but the programme was cancelled in June 1957.

Canadair CL-52

Perhaps the unlikeliest B-47 to take to the skies was the Canadair CL-52, a one-off engine testbed. Structurally it was unusual, but what truly set it apart was the fact that it was the sole example of a B-47 that was operated by a foreign nation.

In the mid-1950s, Canada, in the form of the Avro Canada corporation, was serious about getting into the advanced high speed interceptor business. To this end Avro was hard at work on the Arrow, which would prove to be an impressive Mach 2 aircraft when it first flew in 1958. To achieve that performance it needed an equally advanced and powerful turbojet engine, the Orenda Iroquois. Avro looked at a number of aircraft to serve as a testbed for the engine… the aircraft needed to be large, fast, and readily modifiable. In the end Avro determined that the B-47 was the best aircraft for the role, and the USAF agreed to lend TB-47B number 51-2051 to the Royal Canadian Air Force in February 1956.

Work began immediately to modify the airframe. A single Iroquois in a nacelle was attached to the right rear fuselage of the B-47; the added weight so far aft meant that 10,000lb of lead shot ballast was added to the nose of the B-47. Fuel lines, instrumentation, structural enhancements and armour plating were added to the aircraft to accommodate the engine, which was toed-out 5° to partially make up for the asymmetric position of the engine. The modification work was done by Canadair, Ltd, under contract to the engine manufacturer Orenda Engines. Canadair designated the modified aircraft the 'CL-52' and began flying on November 13, 1957. The asymmetrical thrust proved troublesome, but manageable; at high power the three J47 turbojets on the starboard side were reduced to idle power while the outboard port engine ran at full thrust. On one flight all of the J47 turbojets were shut down and the aircraft flew perfectly well simply on the thrust of the Iroquois. Given that the engine was capable of producing 19,350lb of dry thrust and 25,600lb of thrust with afterburner, that ability is not surprising.

The Avro Arrow, and the Iroquois along with it, was cancelled in February 1959. This decision had been debated furiously ever since, with the general consensus being that it was short sighted (usually using colourful metaphors for emphasis). In the end the CL-52 only racked up 31 hours of flight time with the engine running; only once did it attempt a full power (with afterburner) run, shedding several turbine blades and damaging the rear fuselage and horizontal stabilizer. The aircraft was returned to the USAF and scrapped at Davis-Monthan by mid-August 1959.

BRASS RING and WEARY WILLIE II

In World War II, Project Aphrodite took B-17 and B-24 bombers that were at the end of their service lives and modified them into remotely piloted flying bombs. One last mission would see the planes filled with many more tons of high explosives than they would normally carry; they would take off under the control of a pilot who would bail out some time shortly afterwards, with the plane under control of another pilot in another aircraft, directing it by radio control. Early television cameras would allow the remote pilot to crash it directly into the enemy target. It proved an effective use of bombers that were meant for the scrap heap, though the programme was not without the occasional catastrophe.

As the era of atomic warfare loomed, the idea was revived. Project BRASS RING arose in 1950 as a way to allow the B-47 to carry a heavy nuclear weapon deep into the Soviet Union and also allow the crew to survive the trip home. This idea was that a single B-47 director aircraft could control one or more unmanned B-47s heavily laden with nuclear weapons. The unmanned aircraft would be flown as remotely piloted cruise missiles; the director aircraft would not be armed but instead filled with fuel

Boeing B-47E

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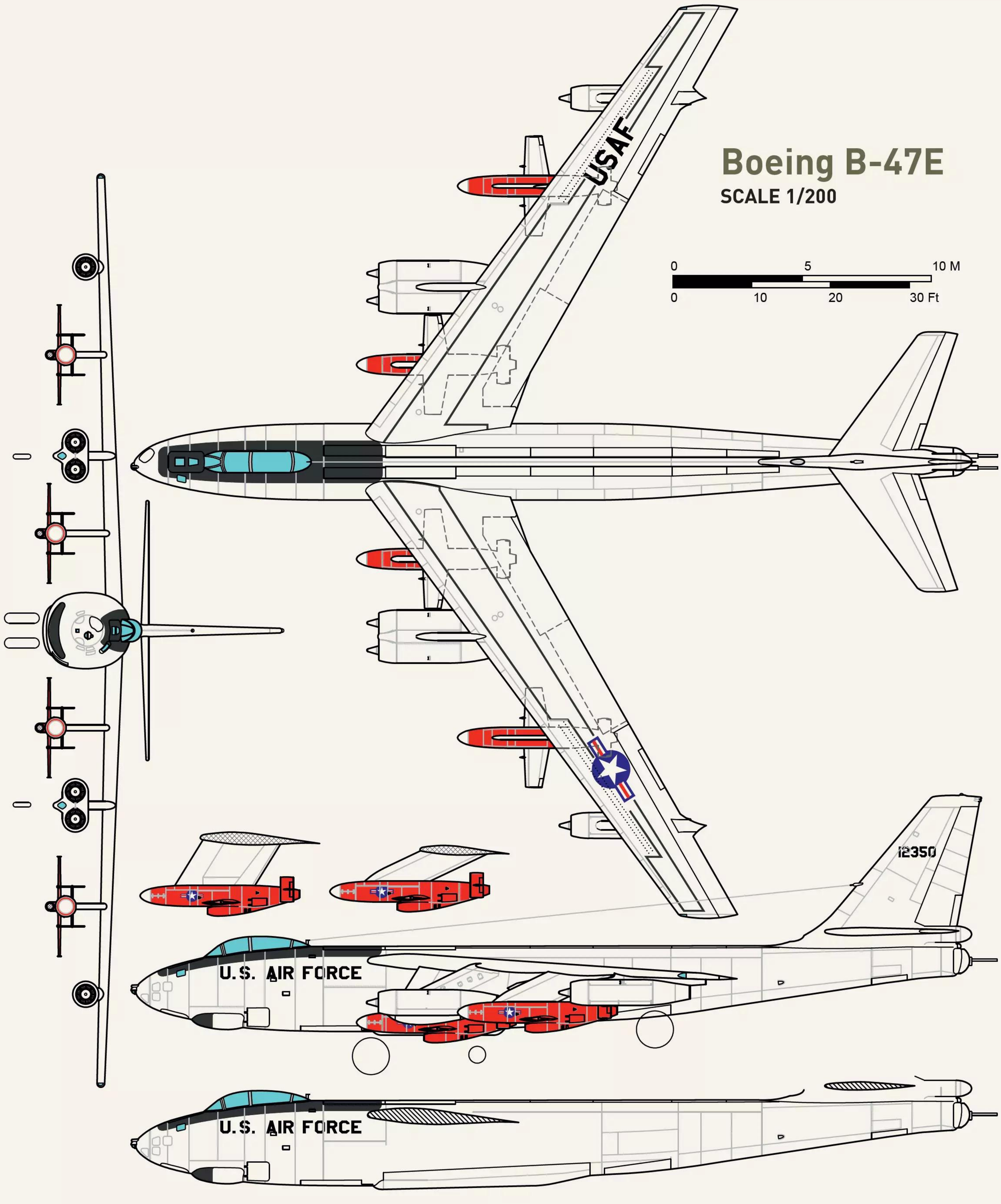

Canadair CL-52

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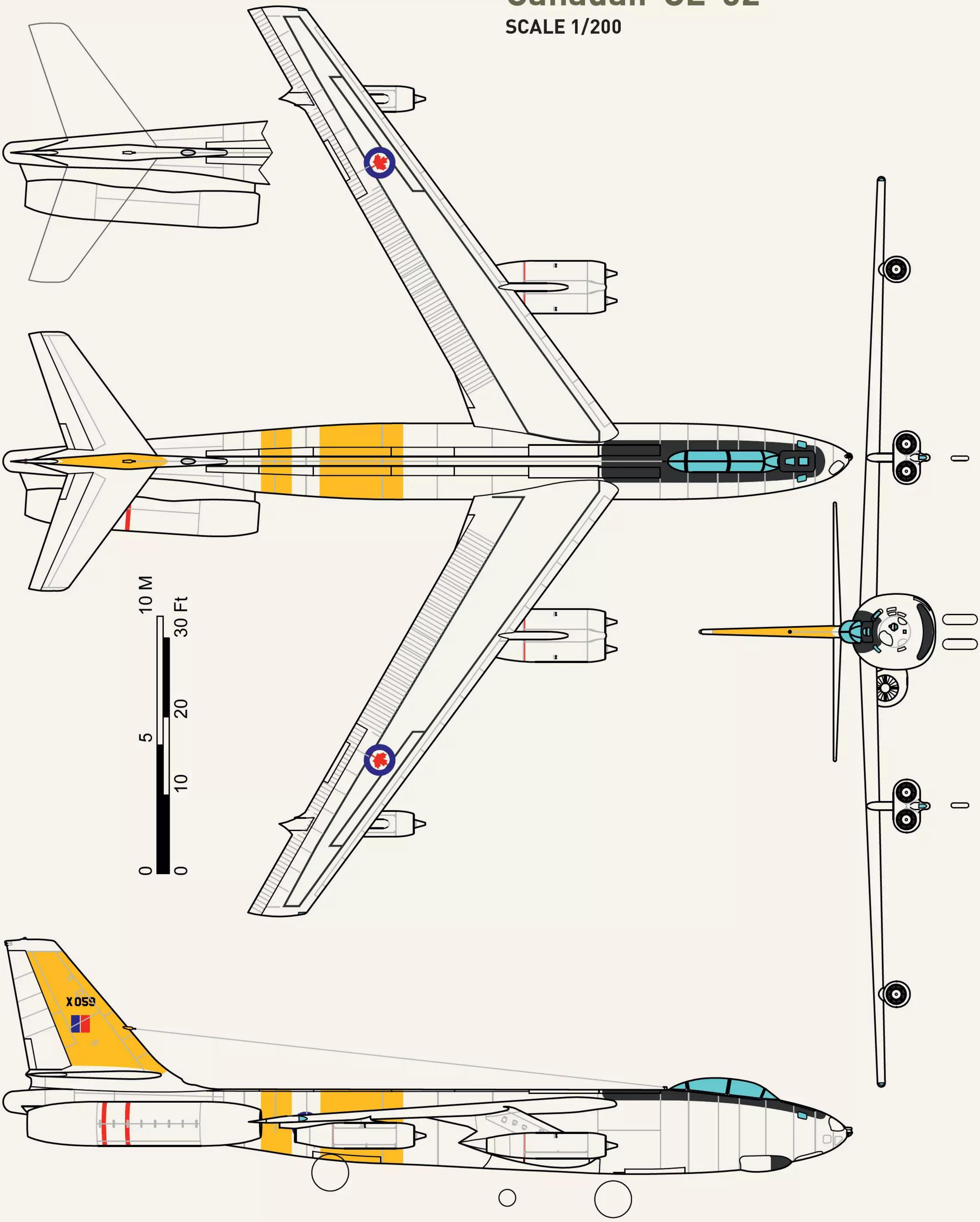

for the return trip. One B-47A was converted to a DB-47A 'Director' aircraft and two B-47Bs were converted into MB-47B flying bombs. After some effort, and a switch from North American to Sperry Gyroscope for the control equipment, the idea was made to work and by mid-1952 both the DB-47A and the MB-47Bs were flying. However, projected costs were excessive and with advances in retarded bomb design and the acquisition of forward bases for the B-47, the need for unmanned B-47s faded and BRASS RING was cancelled in April 1953.

By 1966, though, the idea resurfaced. Now, as with Aphrodite, the issue was what to do with obsolete bombers. As with Aphrodite, the notion of converting old B-47s into flying bombs was studied. Project WEARY WILLIE II proposed the use of unmanned QB-47s controlled remotely by back-seat pilots in DF-100F fighters flying anywhere from 15 to 50 miles behind. A payload of 35,000lb of explosive slurry (presumably something like fuel oil mixed with ammonium nitrate) would be carried, not only in the bomb bay but within some of the aircrafts fuel cells. WEARY WILLIE II QB-47s were proposed for use against North Vietnamese targets such as bridges; even with the expenditure of entire bombers, the math worked: the loss of a single retired bomber was cheap compared to the bombing campaigns carried out by wave after wave of F-105s, some of which were expected to be shot down. But even though the math worked, the project was not advanced to actual practice.

Studies upon studies

Before the B-47 entered service, Boeing was already looking at ways to improve the design, to increase range or speed or payload. This is of course only to be expected; in the fast-paced world of late 1940s aeronautics, if you weren't moving forward, you were being passed. And not just by your nearest competitor… at the time there were many companies that would have liked to have replaced Boeing in the limelight, and Boeing knew it.

Faster still

The Boeing B-47 was a fast aircraft for its day, but it was not a supersonic one. As the B-47 was being developed supersonic aircraft were fast approaching, and a supersonic bomber was clearly not going to be too far away. The best supersonic bomber would be one designed from the outset to be optimised for the role… but a supersonic bomber based on an existing aircraft could well be available sooner. And the first manufacturer with a supersonic bomber, as un-optimised as it may be, would be well positioned for the future.

Boeing proposed several high speed and supersonic B-47 derivatives, all with recognisable B-47 fuselages and canopies… but with altogether new wings and engine arrangements.

Boeing Model 450-65-10

With the Model 450-65-10 series, Boeing studied a high speed – likely supersonic – version of the B-47. To achieve this, the long-span high aspect ratio wing of the B-47 was removed and replaced with a highly swept wing of shorter span, with the wing configurations taken from the contemporary Model 484 supersonic bomber studies. The six podded engines were replaced with four afterburning turbojets located just under the wing roots, with inlets beneath the wings and exhausts just aft of the trailing edges. A number of variations on the wing and fuselage were studied.

Model 450-65-10A had a largely unmodified B-47B fuselage (including the short bomb bay) with a highly swept wing. Model 450-65-10C had the same wing, but added a pointed fairly to the nose; Model 450-65-10F used the same modified fuselage, but added a wing somewhat less swept but with somewhat great span. Unfortunately, performance data is not available, though it seems likely that the –10C version would have had the highest top speed, the -10F the greatest range.

A curious episode in the story of the B-47 was its inclusion in the MX-1712 programme. The B-47 – fast though distinctly subsonic – was proposed as the basis for an aircraft that would eventually compete directly against the double-sonic Convair B-58.

Running parallel to Convair's development of the B-58 was Boeing's effort to develop what would eventually be designated the B-59. In February 1951, Boeing began a Phase I contract for project MX-1712 with the USAF to develop a medium range strategic bomber capable of supersonic dash. Building upon aerodynamic research carried out under earlier studies, Boeing assigned model number 701 for MX-1712. Initial requirements for MX-1712 included a basic mission radius (with a 200 nautical mile supersonic dash) of 1737 nautical miles, with a gross takeoff weight of 200,000lb. Cruise speed was to be 530 knots with a basic mission dash speed of 860 knots and a maximum speed of 1150 knots. The engines were to be Wright J67-W1 turbojets with afterburning and the payload was assumed to be a single 10,000lb nuclear bomb.

Strategic Bombardment General Operating Requirements SAB-51, from December 1951, and Strategic Reconnaissance General Operating Requirements SAR-51 from February 1952, began to lay out the requirements for what would become the XB-59. Boeing programme MX-1965 was an outgrowth of MX-1712. MX-1965 was seen by the USAF as a conservative backup to the more aggressive Convair MX-1964 (which became the B-58).

The Wright J67s were replaced with a new General Electric engine, the J73-X-24A which was predicted to have improved specific fuel consumption. The warhead was reduced in size and combined with a jettisonable fuel tank. The bomb/tank combination was to weigh

Boeing Model 450-65-10A

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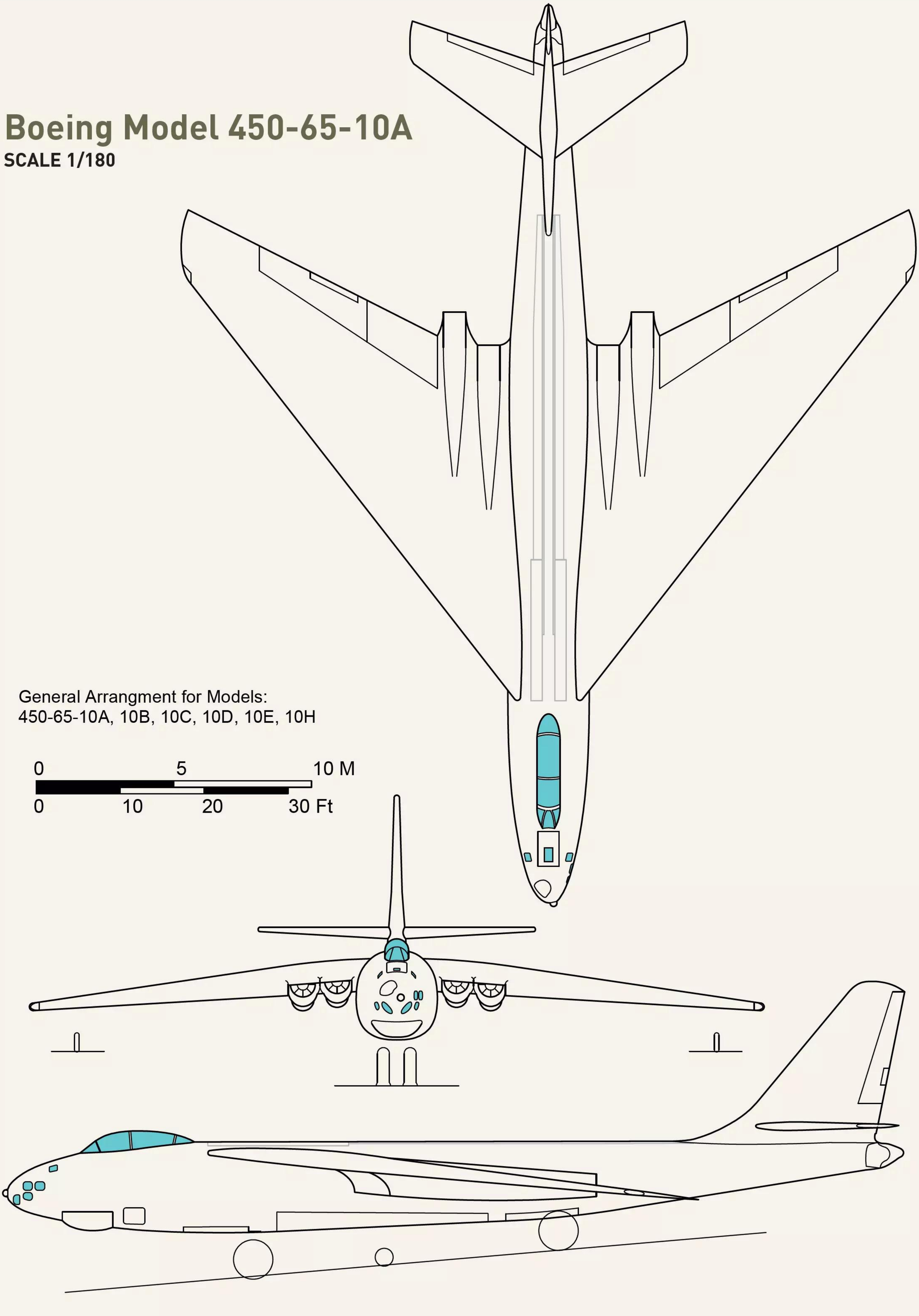

General Arrangment for Models:
450-65-10A, 10B, 10C, 10D, 10E, 10H

0 5 10 M

0 10 20 30 Ft

Boeing Model 450-65-10A
Boeing Model 484-2-2

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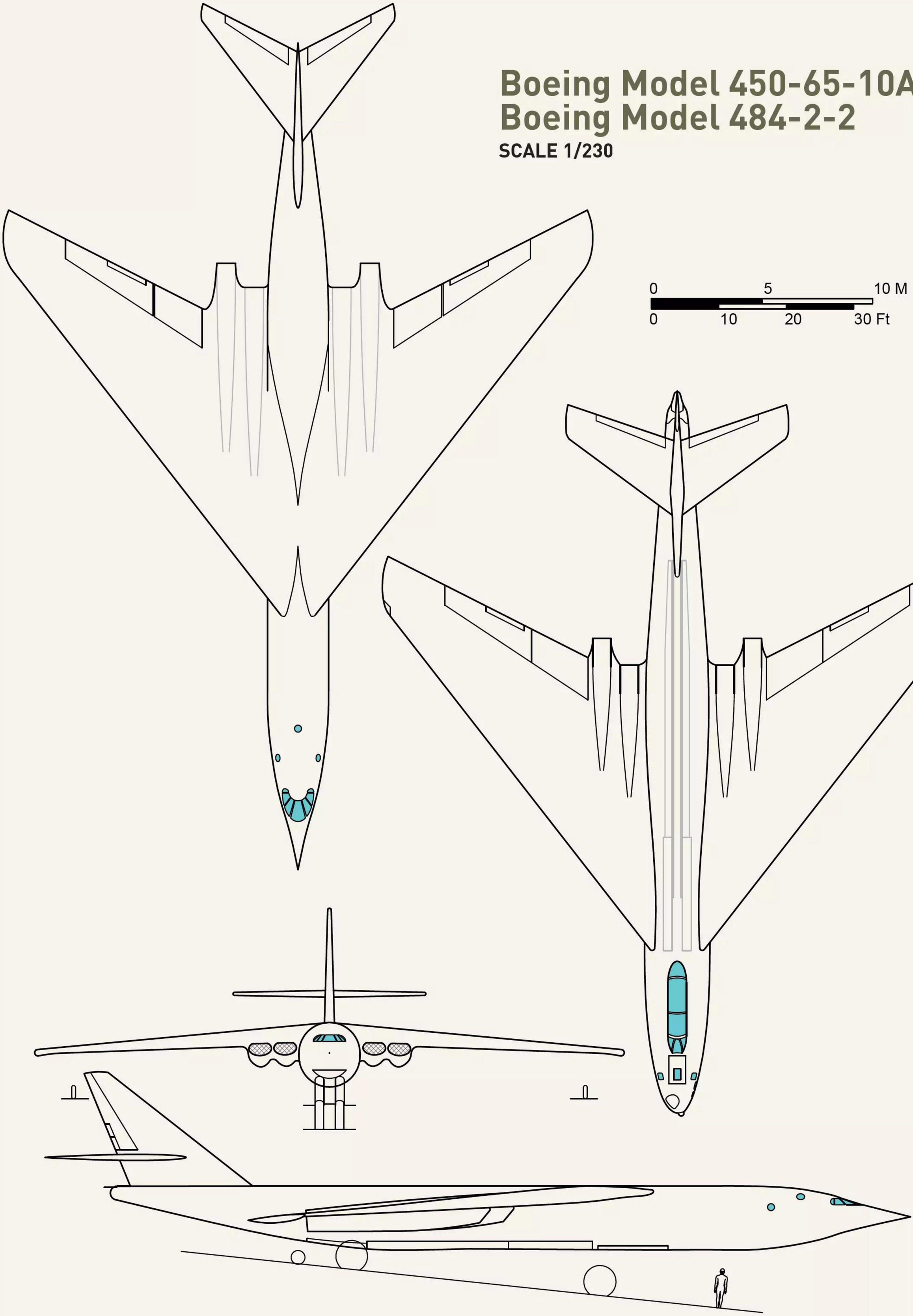

Boeing Model 450-65-10C

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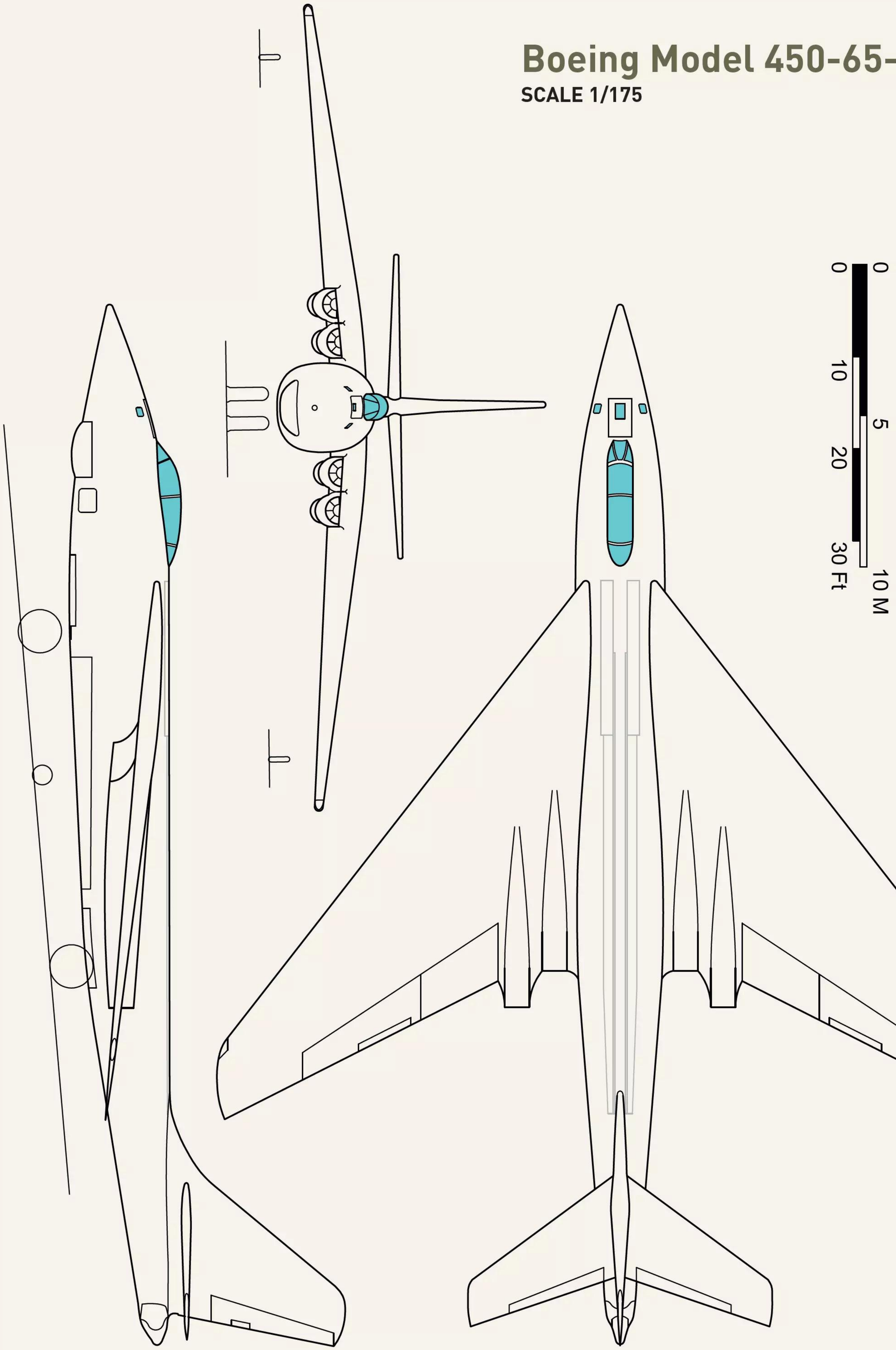

Boeing Model 450-65-10F

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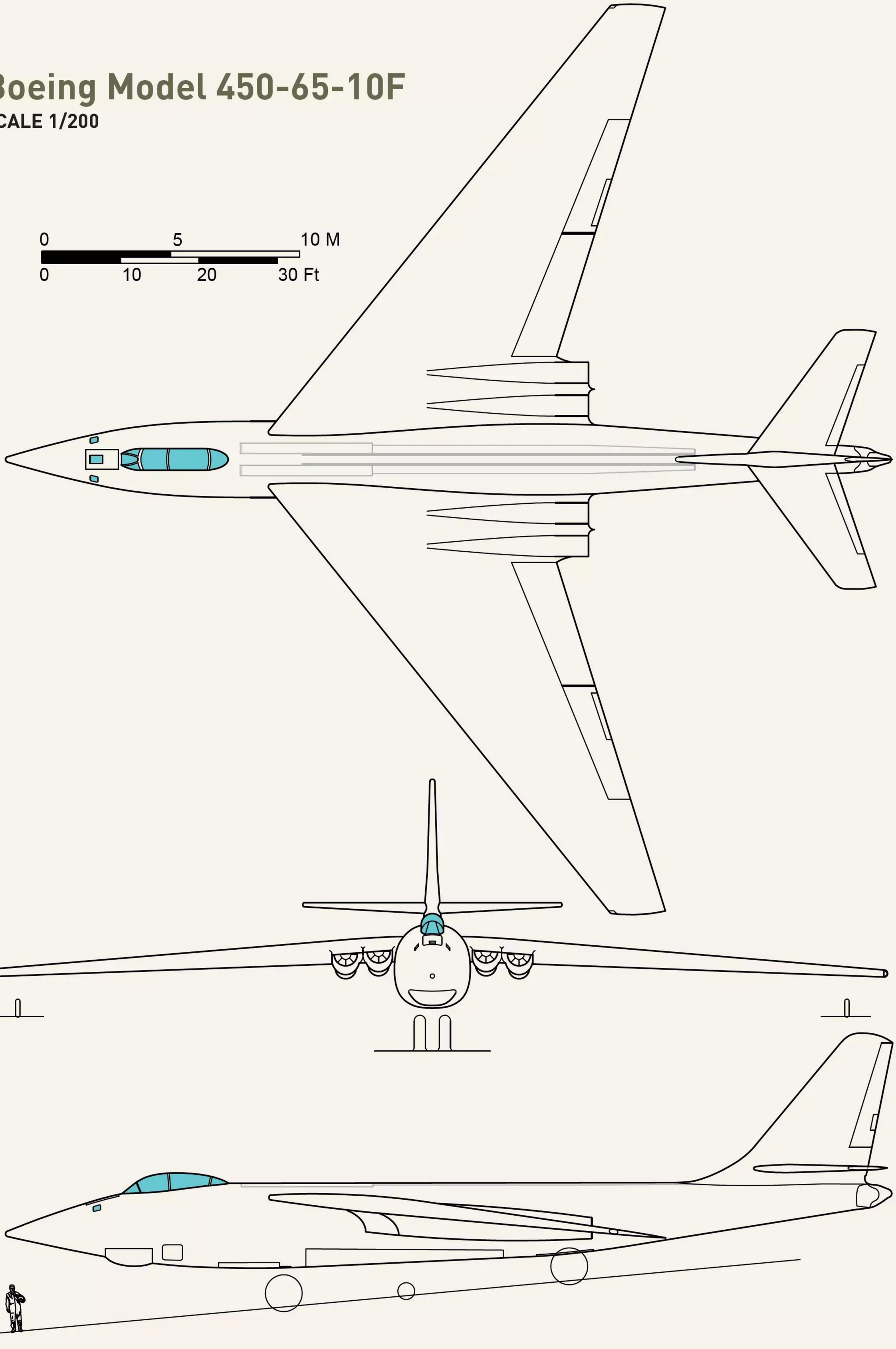
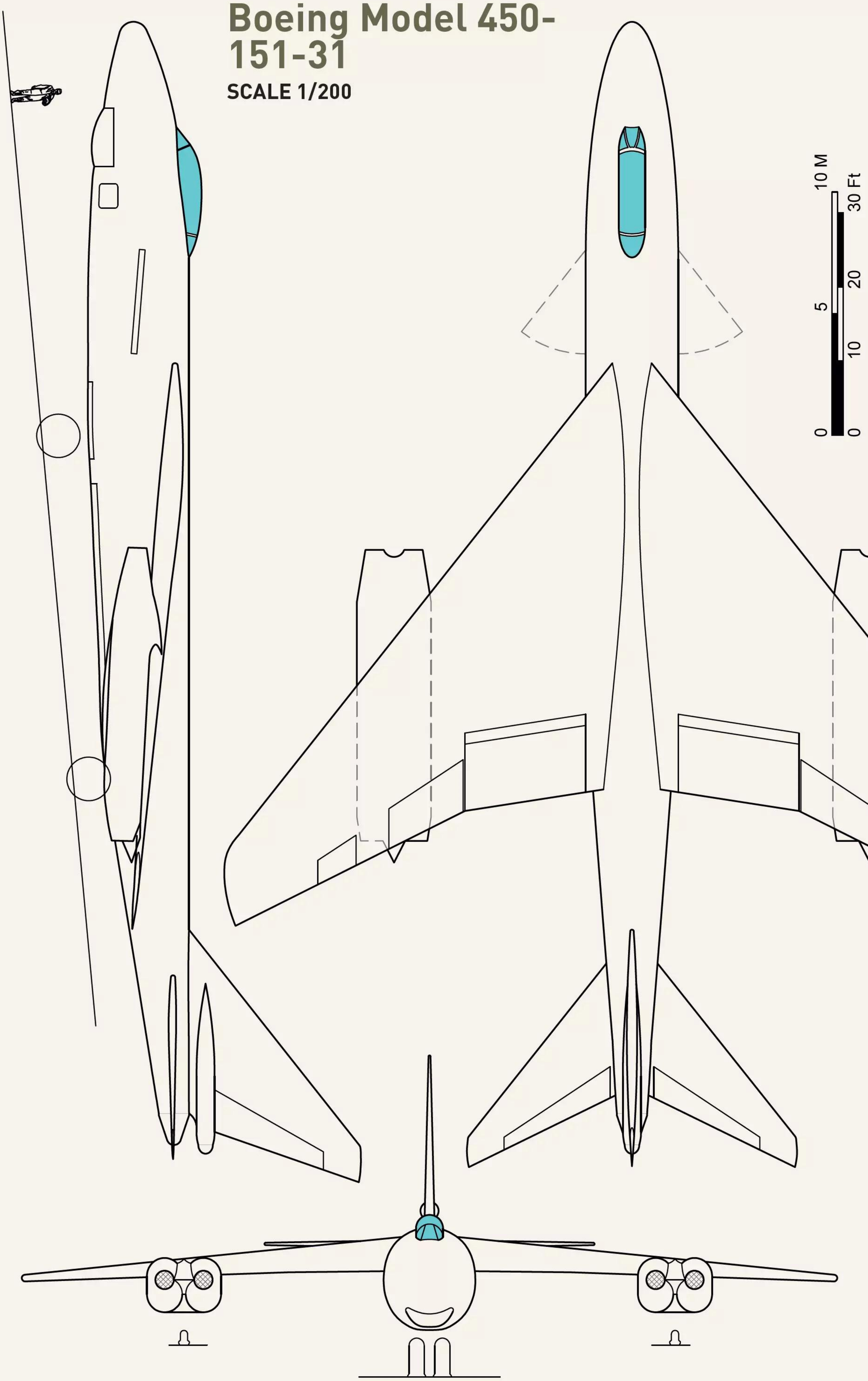
0 5 10 M

0 10 20 30 Ft



Boeing Model 450-151-31

SCALE 1/200



Boeing Model 450-152-27

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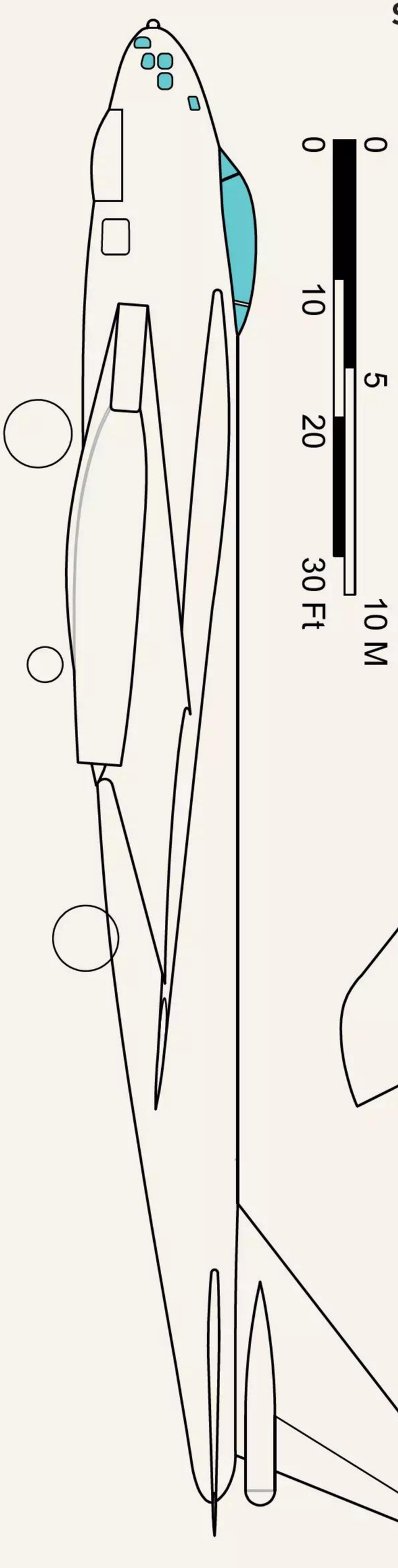

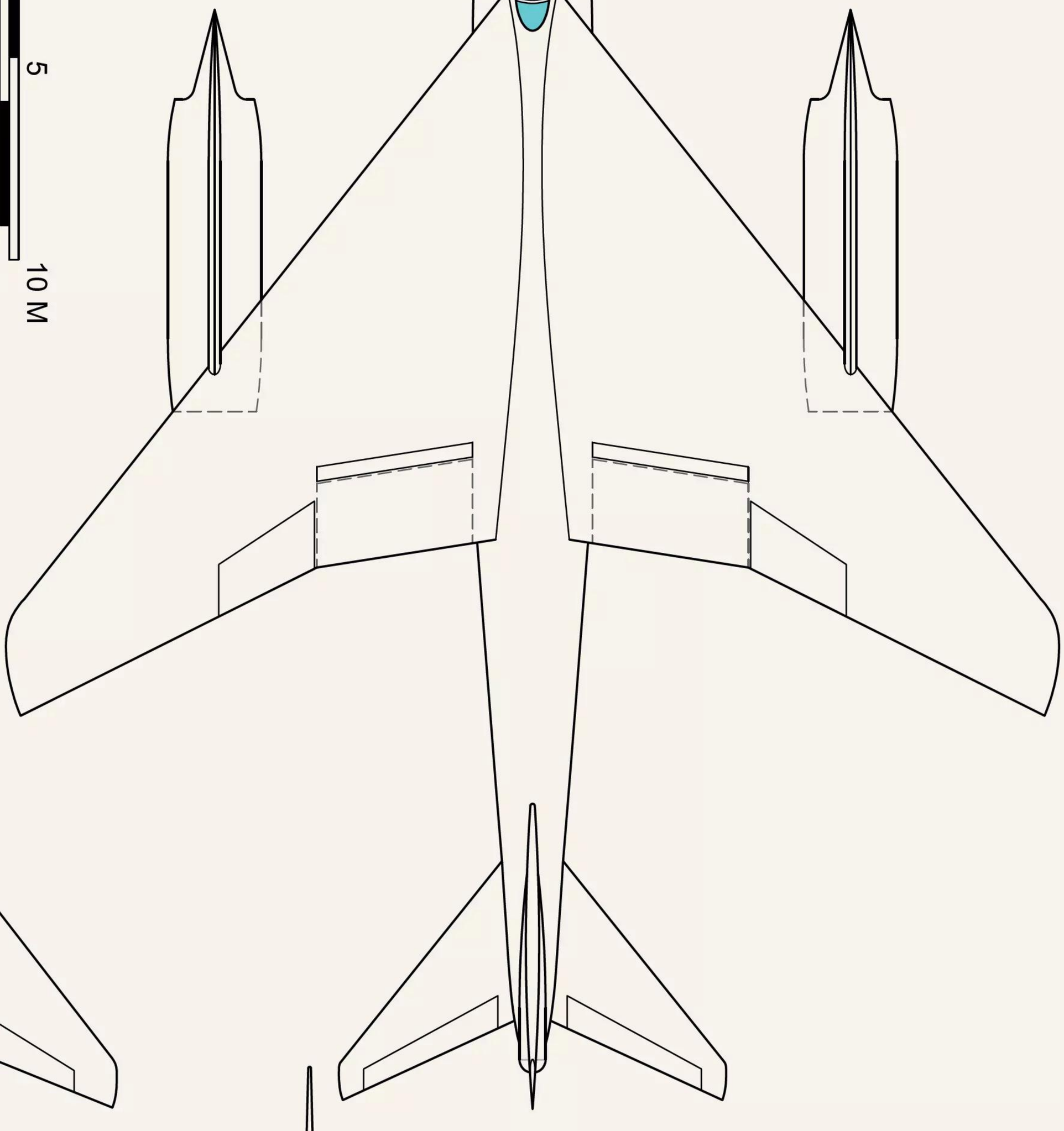

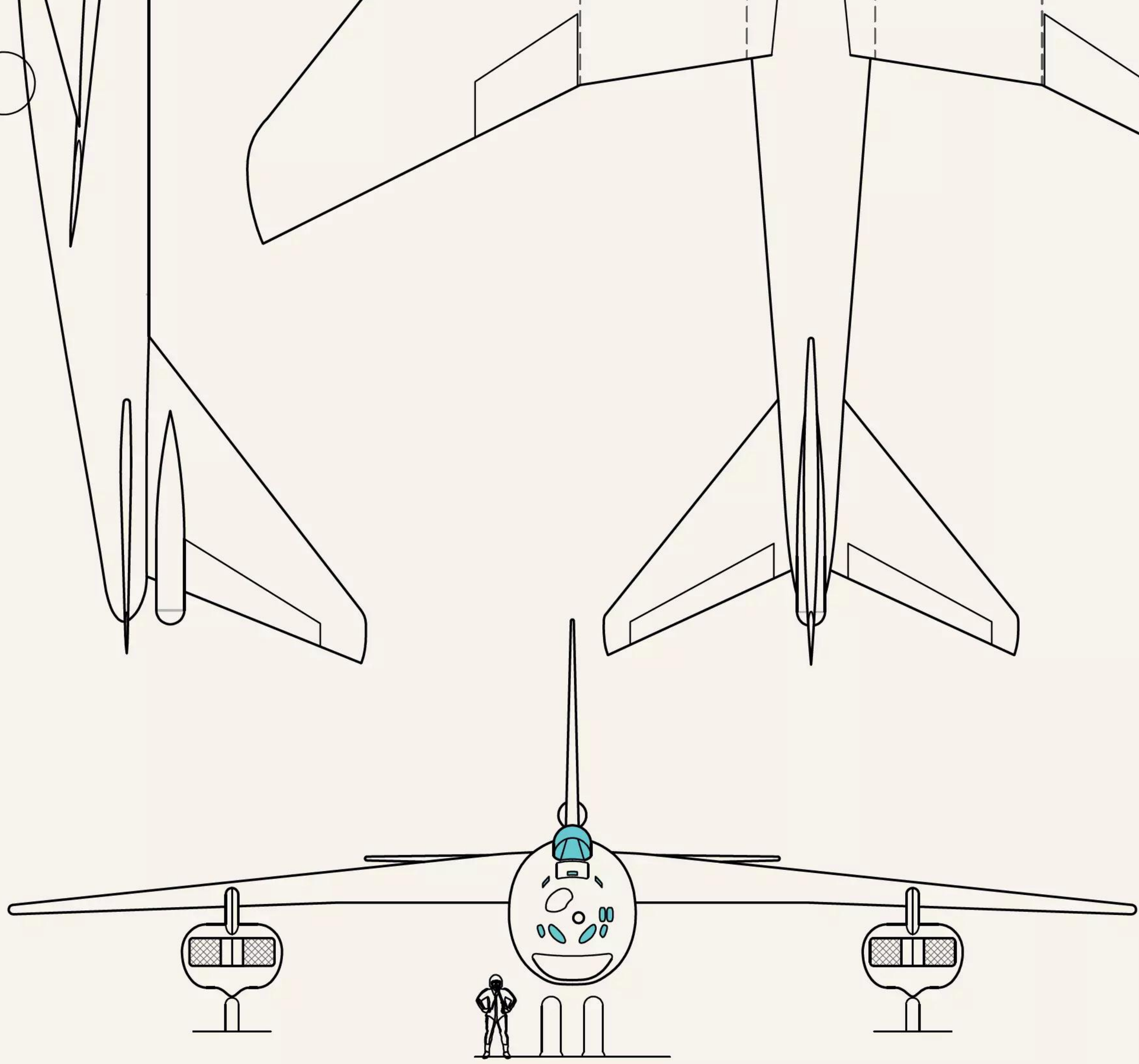

Boeing Model 450-154-32

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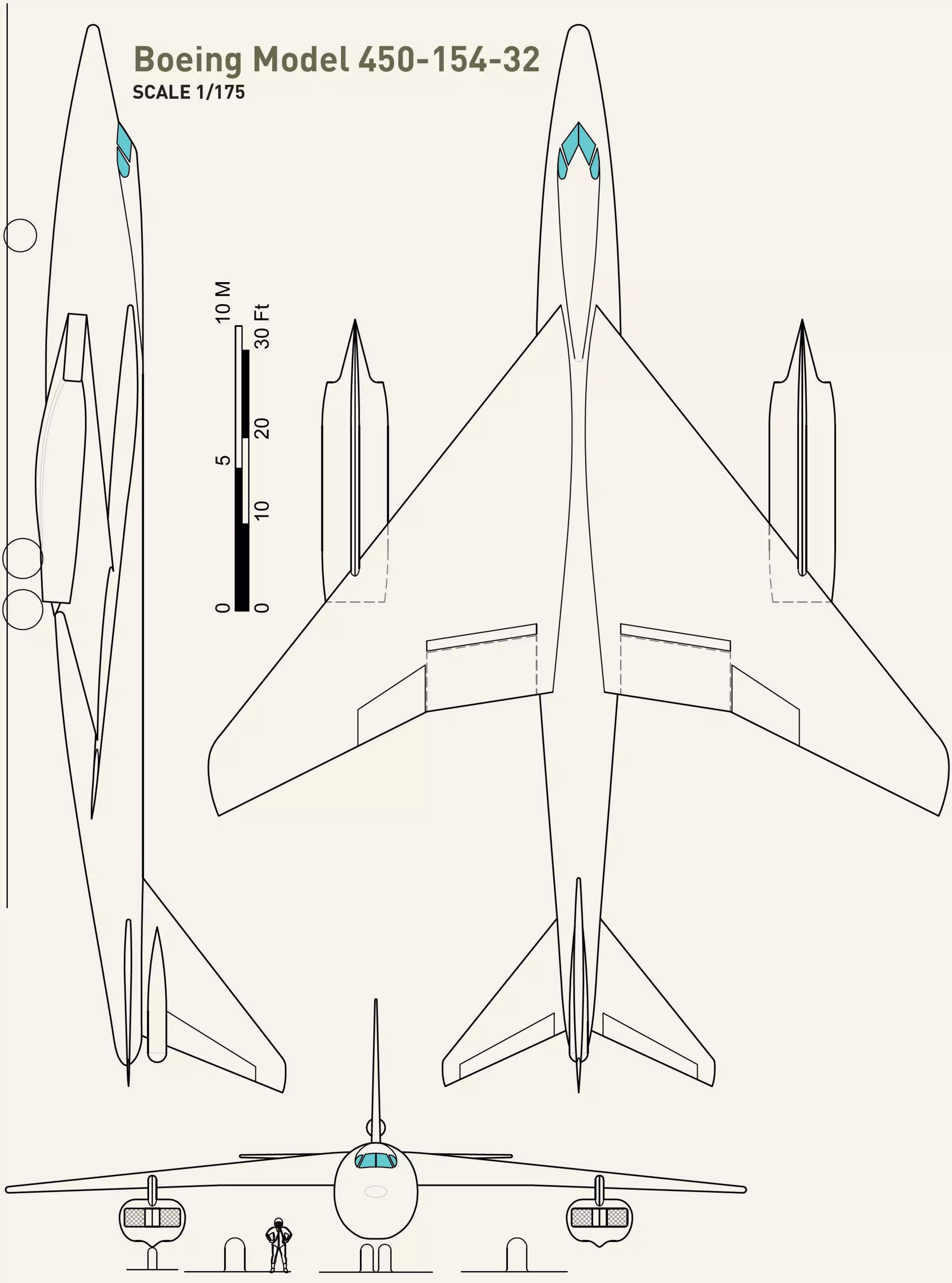
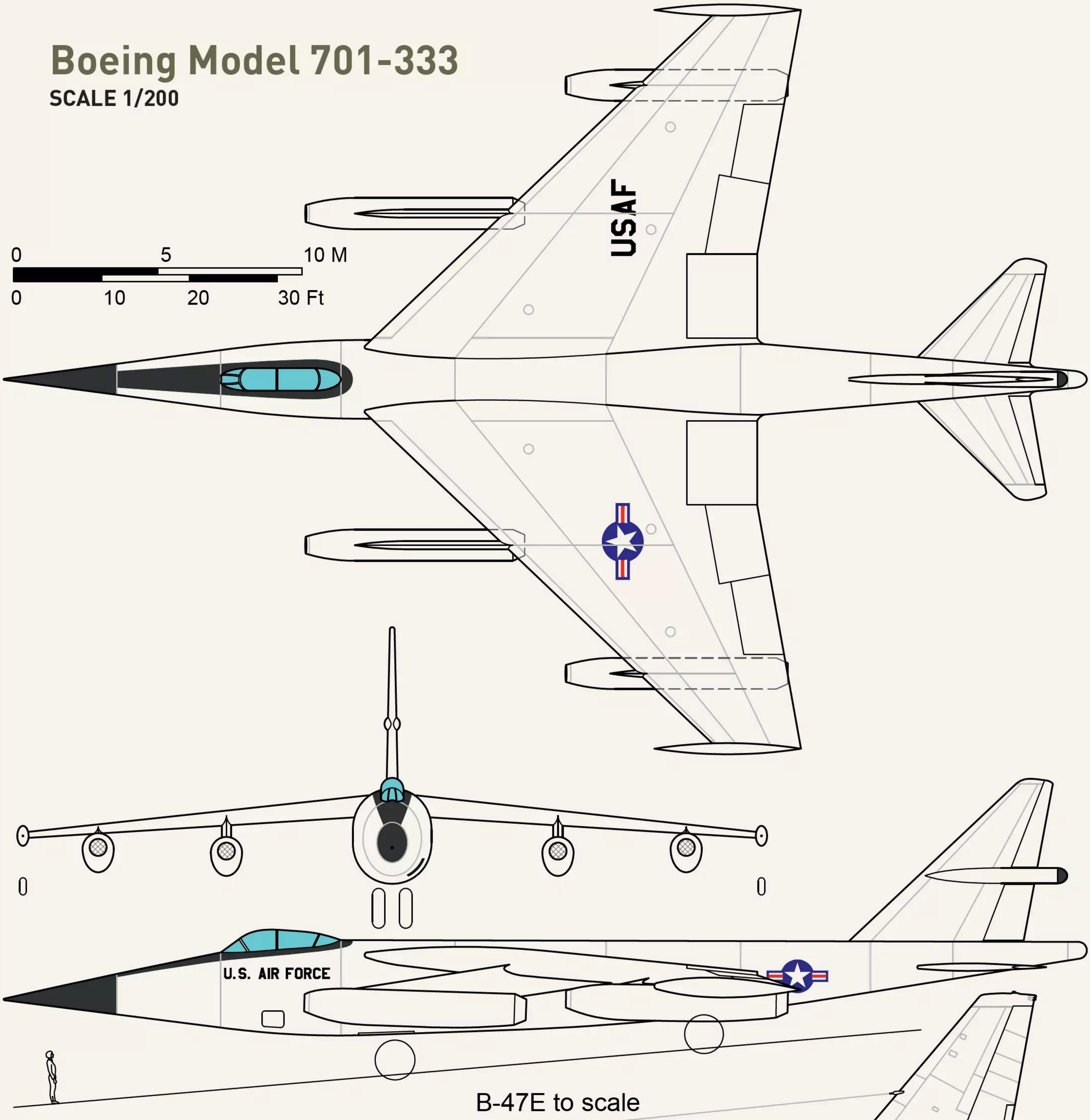
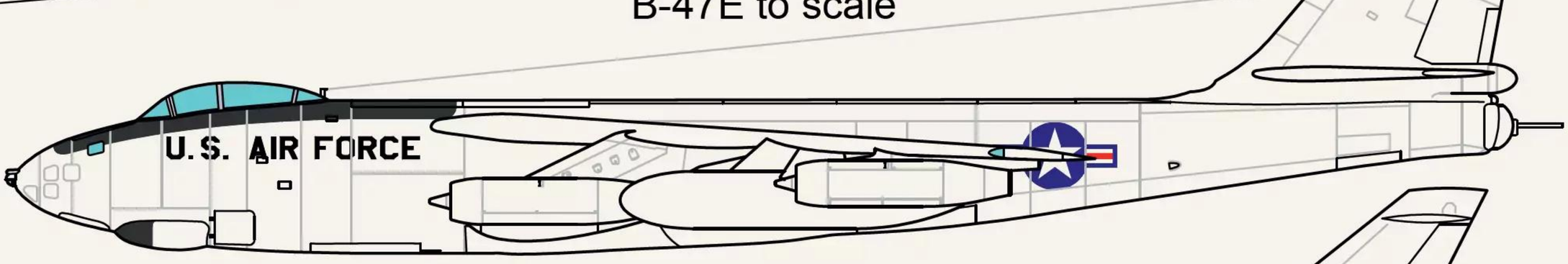


Boeing Model 701-333

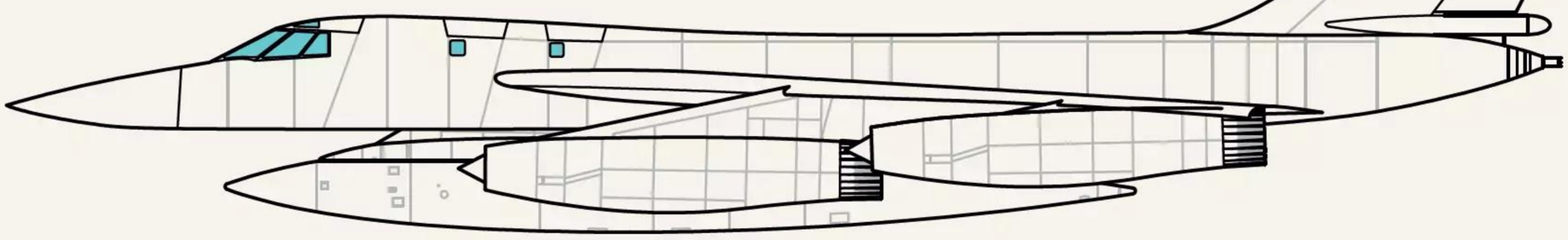
SCALE 1/200



B-47E to scale



Convair B-58 to scale



in at 7,700lb, a substantial reduction from the MX-1712 baseline. Other advanced technologies were to be utilised... a high velocity 30mm cannon in the tail for defence, new aluminium and titanium structural alloys, inflight refuelling and new electronics and avionics.

With the great success being demonstrated by Convair, the MX-1965 programme was cancelled in 1953. The ultimate design, Boeing Model 701-299-1, dating from August 1953, was what has become known as the XB-59. But even though the MX-1712/1965 programmes were relatively short lived, a wide variety of designs were put forward. And curiously, while most were all-new designs a number of them built in small part or large upon the B-47.

Boeing Model 450-151-31

Boeing Model 450-151-31 used a stretched B-47 fuselage married to an all-new shoulder mounted wing of shorter span and broader chord. Each wing had a single twin-jet nacelle just outboard of mid-span, mounted directly to the wing underside. For added stability at low speed, canards could be deployed from the forward fuselage and stored completely within to reduce drag at high speed. The tail, while similar in appearance to that of the B-47, had surfaces with greater sweepback. While this design had a Model 450 number, clearly associating it with the B-47, it was linked in available documentation with Model 701-238-1, part of the MX-1712 study.

Boeing Model 450-152-27

Model 450-152-27 was, like the -151-31, clearly a modified B-47B. But the fuselage was much closer to the B-47 standard, being about 14ft shorter and much stubbier in appearance. The forward fuselage barely protruded ahead of the wing leading edges; there were no canards, stowable or otherwise. The engine nacelles differed from those of the prior design not only in being held well below the wings via pylons but also in having mirrored vertical ramp inlets rather than simple circular inlets. This design was associated with model number 701-243-1.

Boeing Model 450-154-32

Model 450-154-32, also associated with model number 701-243-1, was a refinement of the previous design. Instead of using the existing B-47 forward fuselage and cockpit canopy – a questionable notion for a supersonic aircraft – an entirely new forward section was designed. This was clearly meant for supersonic speeds, presenting a more sensible pointed nose with sharply angled low windscreens. Data is lacking, but it may well be that the -152 was intended as a testbed for the wings and powerplant, a way to get parts of the MX-1712 into the air quickly.

Boeing Model 701-333

Model 701-333 was another case of a B-47 modified for the MX-1712 programme. The structure of the B-47B fuselage largely remains, but an almost comically long conical nose was added. The wings and engine arrangement was much more like that of the Convair B-58, a nearly delta wing with four individually-podded engines beneath. With the B-47 fuselage as the basic element, it was a notably larger aircraft than the B-58. The B-59 was intended to have an external weapon, much as the B-58 had; the B-47 fuselage had an internal bomb bay and virtually no room under the fuselage for an external weapon of any size. Once again the Model 701-333 was likely to have been intended to be a technology demonstrator rather than an operational aircraft.

3 CHAPTER Miscellaneous Designs

Boeing Model 450-139-10

In the early days of jet engines, there were really only two ways they worked: the pure turbojet, where all the air that went into the engines went through the combustor to be heated and turned into a stream of high velocity exhaust gas, and the turboprop where that energy was mechanically recovered and transferred to a large diameter propeller, used to claw away at a larger mass flow rate of air. But there was a third method, one that in the decades since has become the standard: the turbofan.

Somewhat similar to the turboprop, some of the power of the core turbojet is used to spin a fan, larger in diameter than the powerplant itself. The turbofan is generally not quite as capable of the maximum speeds of a straight turbojet, but they have far better fuel consumption. In general, the larger the fan, the more fuel efficient the engine. Turbofans have in recent decades become efficient enough that turboprops have almost disappeared from the market, largely relegated to smaller aircraft or aircraft intended for relatively slow flight.

Boeing's Model 450-139-10 of May 1951 was designed to take advantage of an early turbofan design, the Allison Model 509 'fan jet'. Described in 1950, it was hardly the first turbofan engine designed; the Germans had tested one in 1943. As of 1951, the turbofan was still largely unknown… but Boeing designers added the engine to the B-47, resulting in Model 450-139-10.

The Allison fan jets were noticeably larger in diameter than the turbojets they replaced. Seemingly as a result of this, the two inboard engines were separated into individual nacelles. It may also be that it was expected that turbofan engines would from time to time shed fan blades; having engines right next to each other would be a good way to ensure that a failed engine would damage another. In any event, the otherwise conventional B-47B-like airframe was distinguished by having six separate engines, the inboard four hanging below substantial pylons, the outboardmost engines attached to very short, almost non-existent pylons. The middle engine pylons were fitted with outrigger landing gear.

Boeing Models 450-148-30 and 450-150-30

Model 450-148-30 and 450-150-30 (also known as model 704) were slightly different versions of the same quite different B-47. As with the YB-47C, these designs had side-by-side seating for the pilot and co-pilot, but in a completely different configuration of cockpit. The change in cockpit was perhaps not the biggest alteration, though… these aircraft were intended for the US Navy. Rather than a bomber, the Model 148/150 was a minelayer. The Class VP minelayer specification was first issued by the Navy in May 1951.

The crew consisted of a pilot, co-pilot, navigator-minelayer, radio-radar ECM operator and a gunner, all in a pressured cabin. The pilot and co-pilot sat side by side; the gunner sat at the rear of the raised, wide cockpit fairing, facing aft and slightly raised. Either the navigator or the ECM operator sat behind the pilots (it's unclear which) and in front of the gunner, while the final crewman sat directly below the gunner. The aircraft featured the long bomb bay originally designed for the B-47 and two radar-guided 20mm cannon in a tail turret, each with 500 rounds.

Model 450-150-30 featured four J57 afterburning turbojets in a configuration similar to the B-47C/B-56. However, the inboard engines were toed inboard by 2.5°. The outboard engines were nearly fixed directly to the underside of the wings, using only a very short pylon; the inboard engines had the longer pylons with offset engines to provide clearance for the outrigger stabilisers.

Model 450-148-30, however, had a compound propulsion system akin to the B-47D, with outboard Wright J67 turbojets and inboard Wright T49 turboprops with 15ft-diameter propellers. The individually podded engines were attached to the wings with very short pylons; the turboprop nacelles were graced with sizable fairings on the underside for the stowage of the outrigger stabilizing gear.

The available diagrams depict neither arrestor hook nor the capability to fold the wings, so it seems likely that they Models 148/150 were not able to operate from aircraft carriers. Both Convair and Martin Aircraft responded to the same specification with jet-powered flying boats; the Martin design won and was built as the P6M Sea Master. Sadly – for Martin, the Navy and flying boat aficionados – only 16 P6Ms were built. That was the end of the line for American military flying boats. The Boeing design might have proven to be more successful.

Boeing Model 450-139-10

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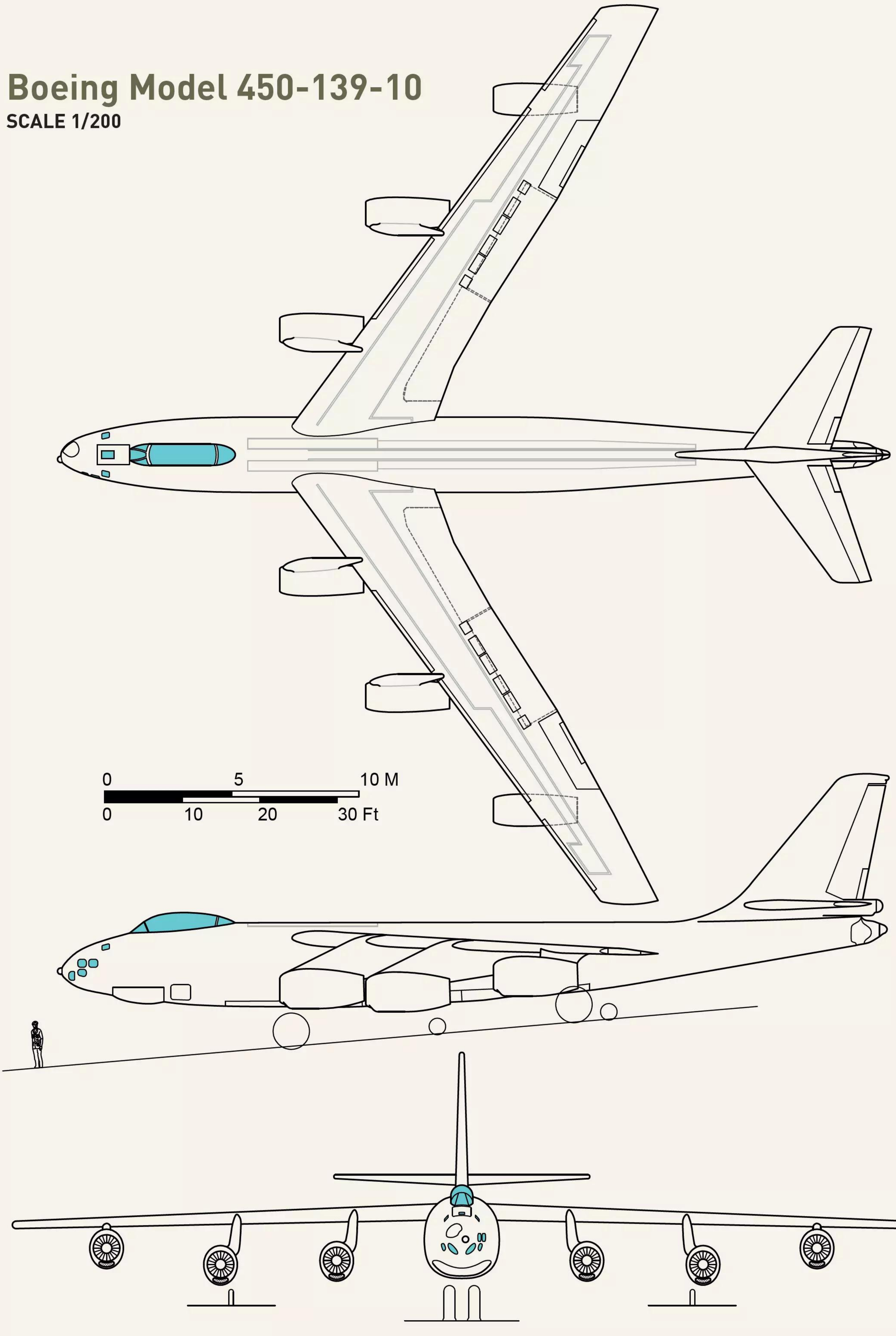

Boeing Model 450-148-30

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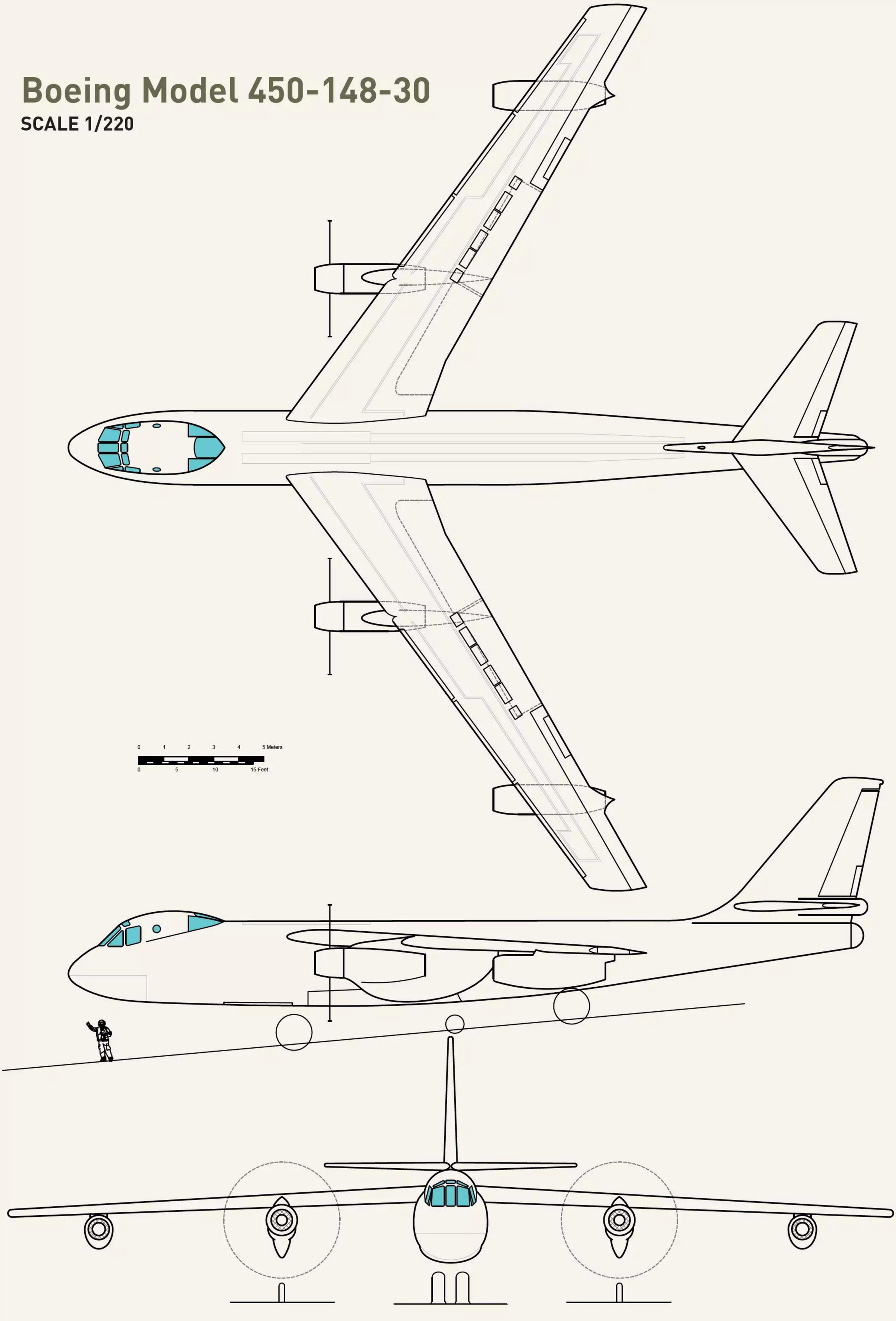

Boeing Model 450-150-30

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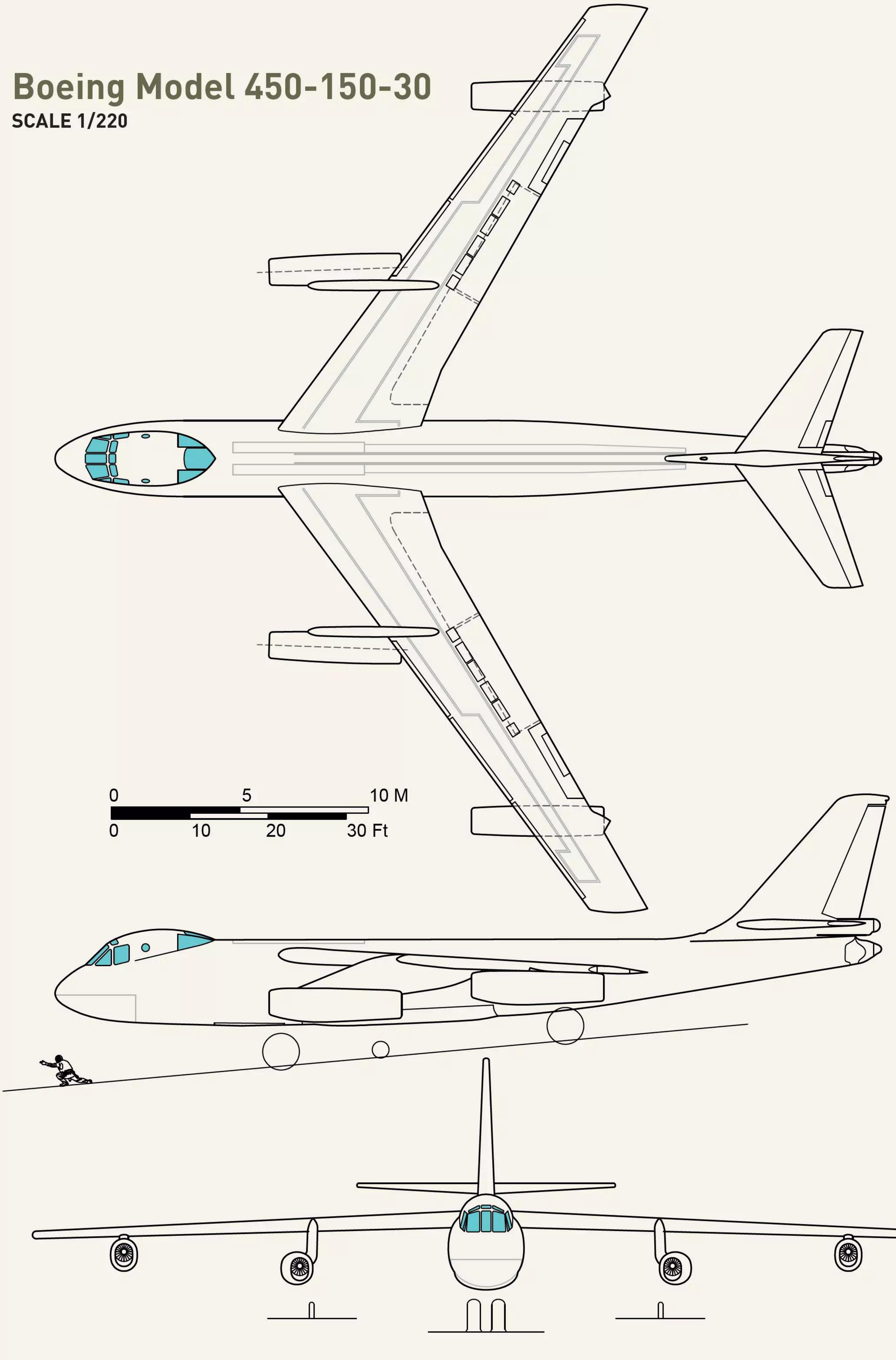

MIT Project LAMP LIGHT

Several important advances in technology, planning and policy have arisen from studies carried out at universities. For instance, 'Project Charles' performed at the Massachusetts Institute of Technology's Lincoln Laboratory (a research centre funded by the federal government to study the needs of national defence) in the summer of 1951 set the stage for continental air defence of the United States through the rest of the 1950s. One important conclusion of the report was the need for a radar system that was indeed created, the Distant Early Warning (DEW) line of radar installations in the arctic of Canada and Alaska that would see incoming Soviet bombers and even missiles in time to do something about them.

A subsequent study was Project LAMP LIGHT. This 1955 study expanded upon Project Charles; where the former had proposed a line of early warning radar sites in the far north, Lamp Light suggested similar lines out in the Atlantic and Pacific oceans. Radar systems fitted to offshore oil-rig like platforms, seagoing 'picket ships' and aerial systems were studied as a way to provide warning time for America in the event of an attack from the sea using ballistic missiles, bombers and supersonic cruise missiles akin to the Navaho.

But in order for those early warnings to mean anything, the United States would need defensive systems able to take down incoming threats… the further from American shores, the better. The study assumed that aircraft such as the Convair B-58 and the Martin P6M could be modified into high-speed long-range interceptors by sometime in the early 1960s, but an interim solution to the problem was put forward in the form of a highly modified B-47E.

MIT suggested that by 1960 the B-47E could be turned into a long-range interceptor capable of carrying the fight up to 900 miles from United States territory. It would carry eight sizable air-to-air missiles, four in the bomb bay and two under each wing. The missiles had a main stage 172 inches long, powered by a single liquid propellant rocket engine. Thrust was variable from 700lb to 2,400lb. For initial acceleration it had a solid propellant booster rocket, increasing total vehicle length to about 18ft; gross weight with booster was 1,354lb. The body had a diameter of 15 inches, which contained a 300lb warhead (too small for an atomic warhead of the time). It also had a pair of sizable wings spanning 85 inches, with a wing area of ten square feet; these supported the 1184lb gross weight missile as it cruised at Mach 2.0 for a duration of 128 seconds. This would give it a range of approximately 54 miles, though the expected mission – launch at 30,000ft, intercepting a target at 65,000ft – would have a nominal range of 30 nautical miles. Guidance of the missile was not firmly determined, but was assumed to likely include a combination of command guidance, infra-red homing and jammer homing.

In order to get the missiles where they needed to be and to find targets for them, the B-47E carrier aircraft would require modifications. The radar fitted to the standard B-47E was designed to look down at the terrain, to aid in bombing; it was of meagre assistance in looking upwards and outwards toward incoming Soviet bombers. So the plan was to install a 3ft by 12ft antennae on top of the aircraft in a rotating dish similar to the rotadomes used on AWACS planes. About two tons of electronics would need to be added to the aircraft to support the new radar system.

The interceptor B-47E would cruise – initially at 23,000ft, and ending at 40,000ft – at 360 miles per hour to a range of 2,700 nautical miles, with inflight refuelling allowing range and duration extensions. The missiles would be stored horizontally in the bomb bay (the outer surface would need some modification to allow the missiles to fit, increasing the depth of the fuselage), but, curiously, the externally carried missiles would be carried rolled 90°, with one wing submerged within the pylons. It's unclear why this was done. MIT assumed that these conversions could be carried out by 1960. Three wings of 135 aircraft were assumed; the aircraft would work in conjunction with a highly integrated series of radar installations and control computers.

A suggestion was made of using an improved B-47 with larger wing area and J57 engines, though details were non-existent. It sounds, however, like the study participants had had access to information on the Model 450-166-38; the timing certainly seems to support this.

There are reports of Boeing studies of using the B-47 as a long-range interceptor, but unfortunately this author has nothing more on them.

All American Engineering Flying Pusher Catapult

The lack of adequate thrust at takeoff was a constant problem for the B-47; the use of the 'collar' full of 33 JATO units was an expensive and logistically complex kludge of a solution. So the All-American Engineering Company proposed a solution of their own: replace the rockets with a jet aircraft that could push the B-47. All-American was a small aeronautical firm that specialised in landing gear, arrestor cable and aircraft launch systems and some unusual projects such as aerial pickup systems whereby an aircraft in flight could snatch up packages or people. They were not in the aircraft manufacturing business… which might explain the rather bizarre 'pusher' project.

The pusher, apparently nicknamed a 'donkey,' was little more than two turbojets, a cockpit, a long nose which would mechanically link to the main aircraft, plus the wings and landing gear needed to recover the vehicle. It would be a lightweight vehicle, with no need for a pressurised cockpit, much navigation equipment

MIT Project LAMP LIGHT

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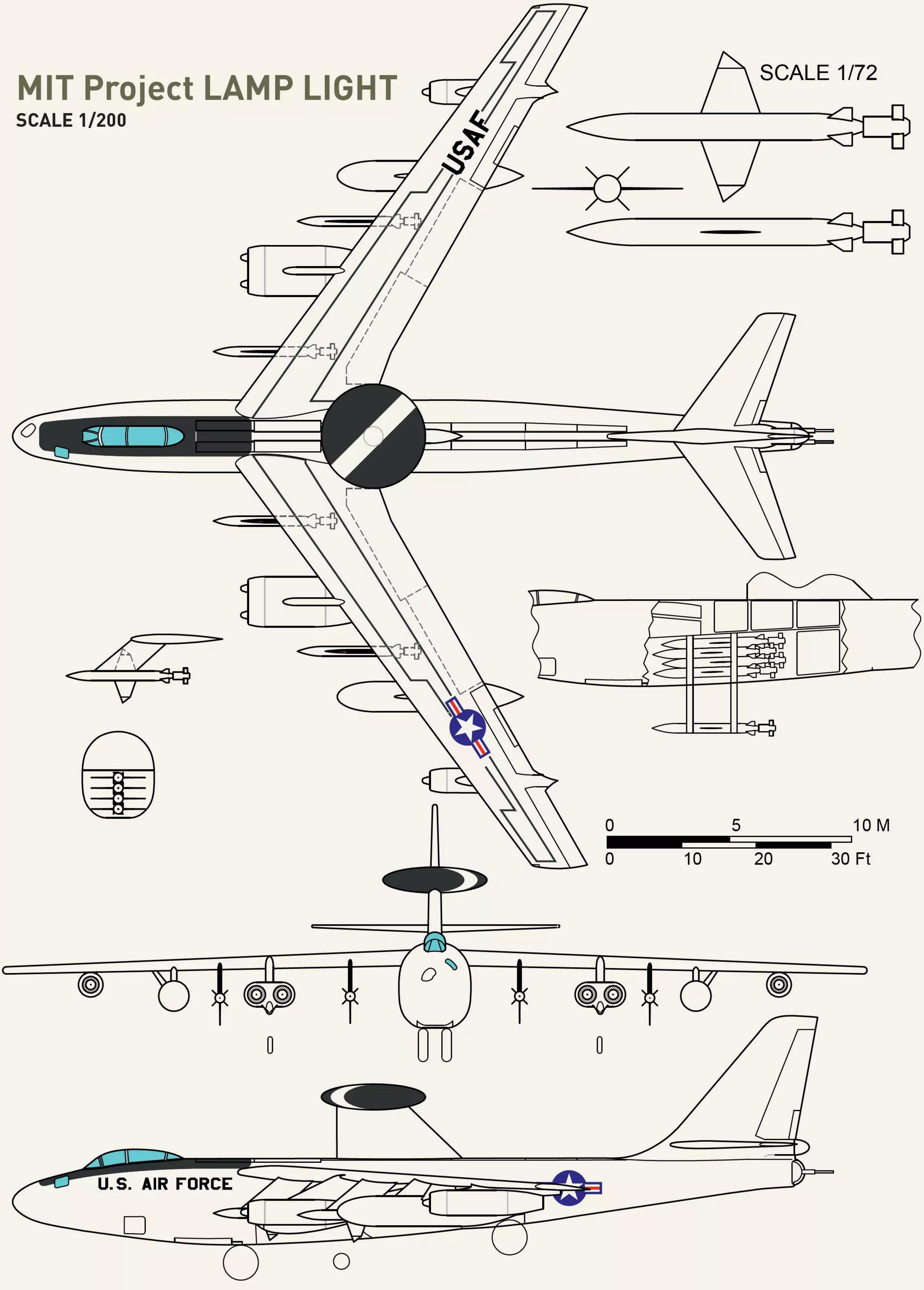

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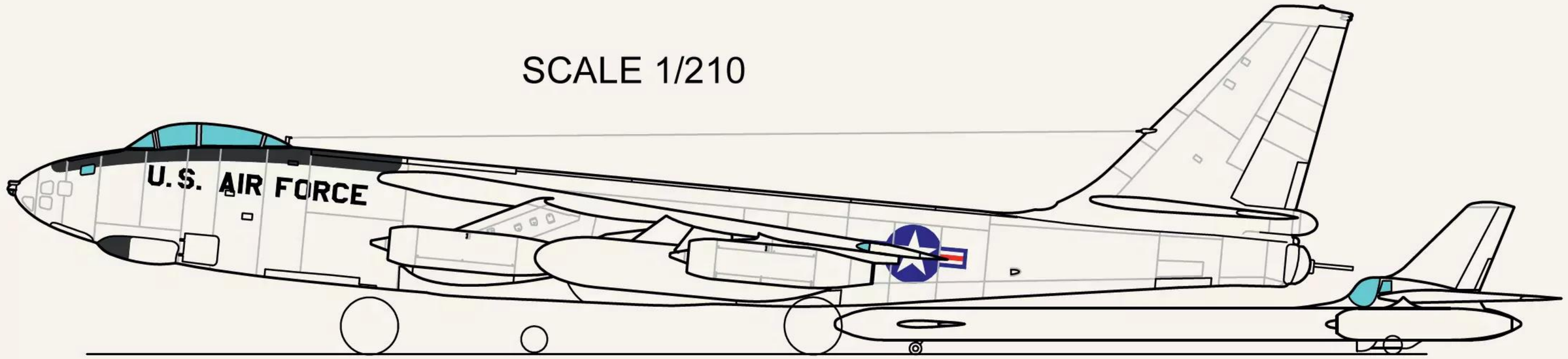

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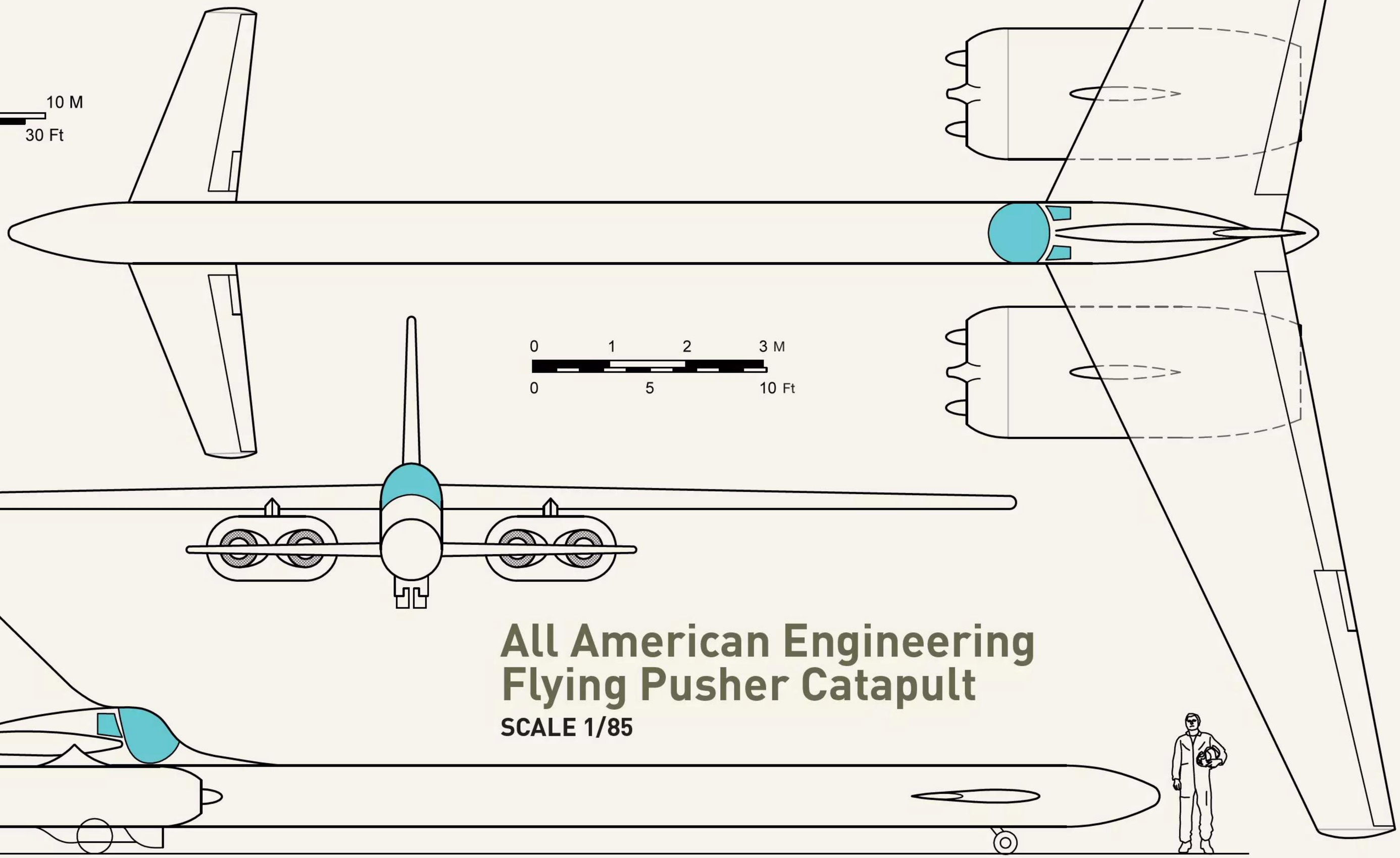

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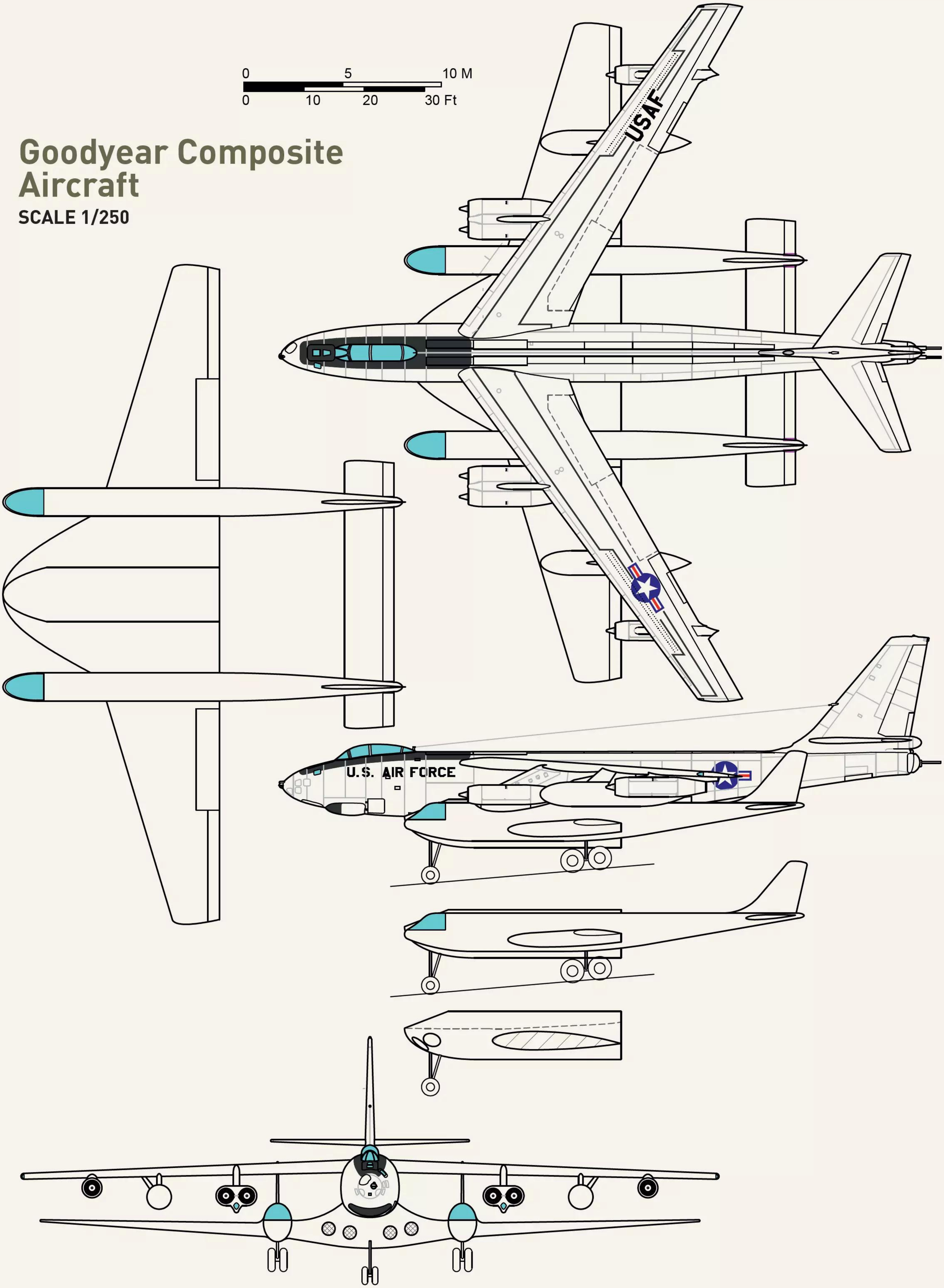
All American Engineering Flying Pusher Catapult

SCALE 1/85

Goodyear Composite Aircraft

SCALE 1/250



or more fuel than a few minutes of flying. The available documentation on this concept, a popular magazine article and a patent, have contradictory depictions of the craft so the diagrams here are somewhat provisional, as is the scale of the craft. No hard data regarding weights, dimensions and performance are currently available.

All-American filed for a patent on this concept in 1956, at which point the B-47 was starting to head off the public stage. It might be thought of as simply an odd little concept from a small and now nearly forgotten company, an idea of little relevance or importance especially since the B-47 was only crudely sketched in to the patent diagrams. But earlier in 1956 a much more famous aeronautical company, Goodyear Aircraft Corporation, filed a patent for a somewhat similar concept. The Goodyear concept would have been not only a more substantial aircraft but also was explicitly meant to boost the B-47. The All-American 'donkey' could have pushed any number of large jet aircraft that had the required modifications, but the Goodyear design was specifically tailored to carry a B-47 on its back.

Not only would the Goodyear design have saved weight for the B-47 by providing takeoff thrust and lift… it would also have allowed the B-47 to save weight by deleting the landing gear. One might be forgiven for wondering how happy the B-47 crews would have been at having to rely on a post-mission rendezvous and docking with a set of flying landing gear.

Extended wings

During World War II, the NACA examined the use of fuel tank 'gliders' that would be towed by bombers to extend range, fuel flowing down hoses from the glider to the bomber. There was a meaningful increase in range, but drag and complexity were increased. Afterwards, German aerodynamicist Dr Richard Vogt used some of the work he'd been involved with during the war (for the side that Boeing bombers happily dropped bombs on) to suggest changing the fuel gliders into wingtip-attached gliders, so-called 'floating wingtips'. Instead of a droppable fuel tanks being simply attached to the underside of the wing or dragged behind and above the plane as a separate glider, the tank would have a sizable wing that would attached to the wingtip of the main aircraft.

The attachment would not be rigid, but allowed to hinge up and down in the roll axis. Little would be needed in the way of active control; under normal flight conditions the 'floating' wingtip tanks would self-adjust. The great advantage here was that tank wings would add substantially to the main aircraft's wingspan and aspect ratio. This would increase not only wing area, but also the aerodynamic efficiency of the wing.

Unlike a similar drop tank simply suspended under the wing, floating tip tanks would make the aircraft more aerodynamically efficient. The same winged tank that would do nothing but add drag to a bomber as a towed glider would turn the bombers wing into something like a sailplane wing… long, thin and substantially more efficient than the original wing. Boeing studied this concept for both the B-47 and the B-52 (see: *US Aviation Secret Projects Issue 2: B-52 Stratofortress* for the B-52 designs).

Boeing Model 450-36-10

Model 450-36-10, from 1950, was essentially a Model 450-16-17 with floating wingtips. The engines were changed from the Westinghouse J40s to Allison J35s and the wings were modified (span shortened 3ft) to accept the wingtip hinges and fuel lines. The wingtips would be able to 'flap' up and down; whether they were meant to be jettisoned when emptied is unclear, but it is probable. The wingtip tanks were equipped with dual-wheel landing gear, to be used at least for takeoff. Range was extended over a thousand miles greater than for the Model 450-16-17. Diagrams depict this aircraft with additional B-47-type drop-tanks under the wings between the inboard and outboard engine nacelles.

Boeing Model 450-57-10

The Model 450-57-10 was to all appearances just the Model 450-36-10, but with the floating wingtips converted into a straight-up extended wing. There was no hinge and no possibility of jettisoning the outer wing panels, though the tanks themselves may have been jettisonable. The Model 450-57-10 without the external tanks would probably have had a truly impressive lift to drag ratio, rivaling sailplanes.

B-36/B-47 Tip-Tow

As bombers grew in range, they quickly outran any practical fighter escort. Until the long-ranged P-51D came along to escort B-17s and B-24s over Europe, many bombing missions ended in catastrophic losses in terms of crews and airframes due to a lack of protection. As bombers grew to truly intercontinental range, fighter escorts would have been simply impossible in the early days of jet technology; the bombers themselves were little more than flying fuel tanks. So the idea grew to add 'parasite' fighters to the bomber that would ride along until needed deep in enemy territory.

The idea had sufficient merit that in the late 1940s Wright Field went forward with practical flight tests, modifying a C-47 cargo plane wingtip to dock with a single Q-14 Culver Cadet. Unsurprisingly some difficulties were found in learning just how to go about docking two aircraft wingtip to wingtip when flight tests began in August 1949, but the wrinkles were ironed out and the two aircraft accumulated more than 28 hours of conjoined flying time during hundreds of flights in late 1950.

Boeing Model 450-36-10

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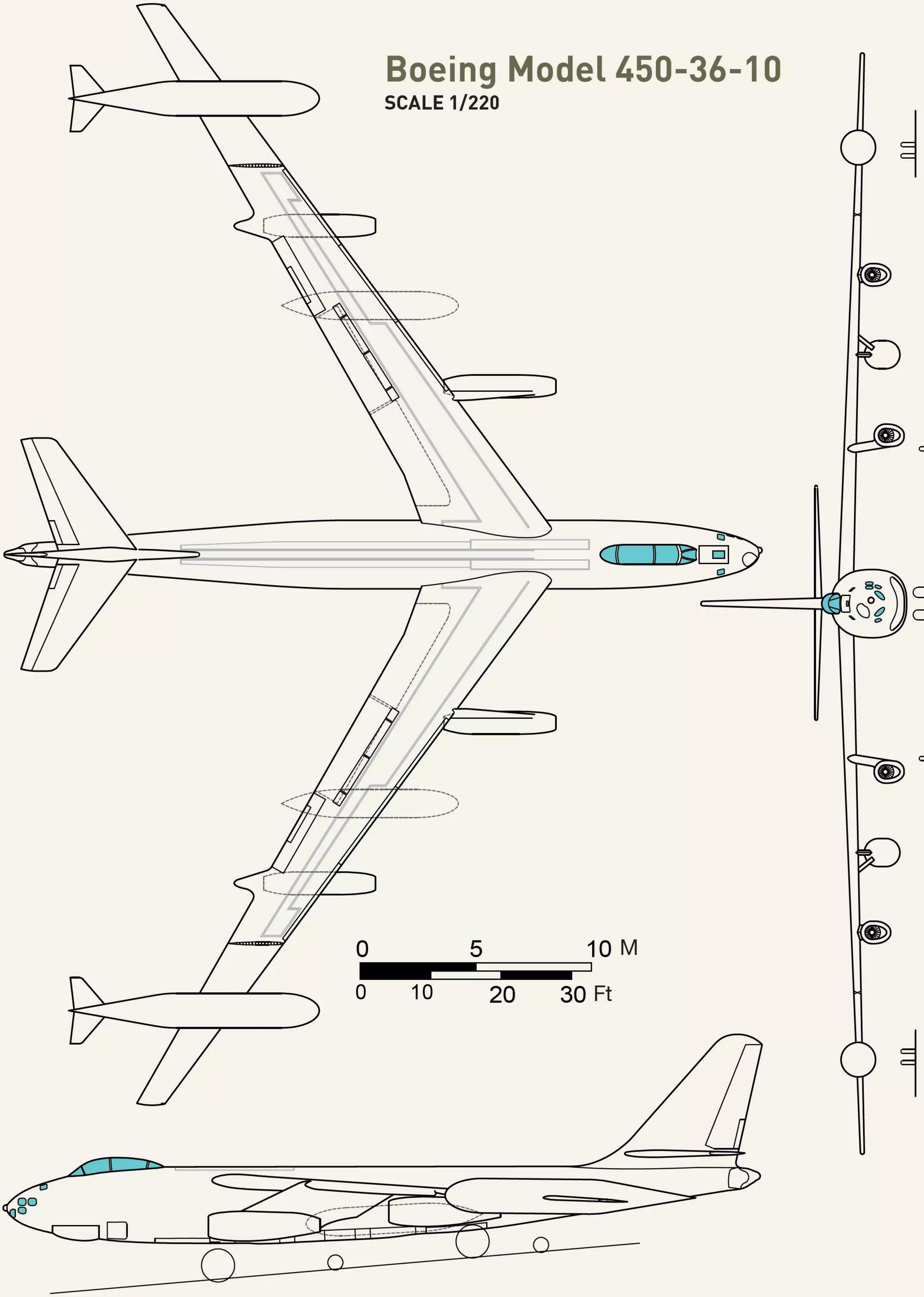

Boeing Model 450-57-10

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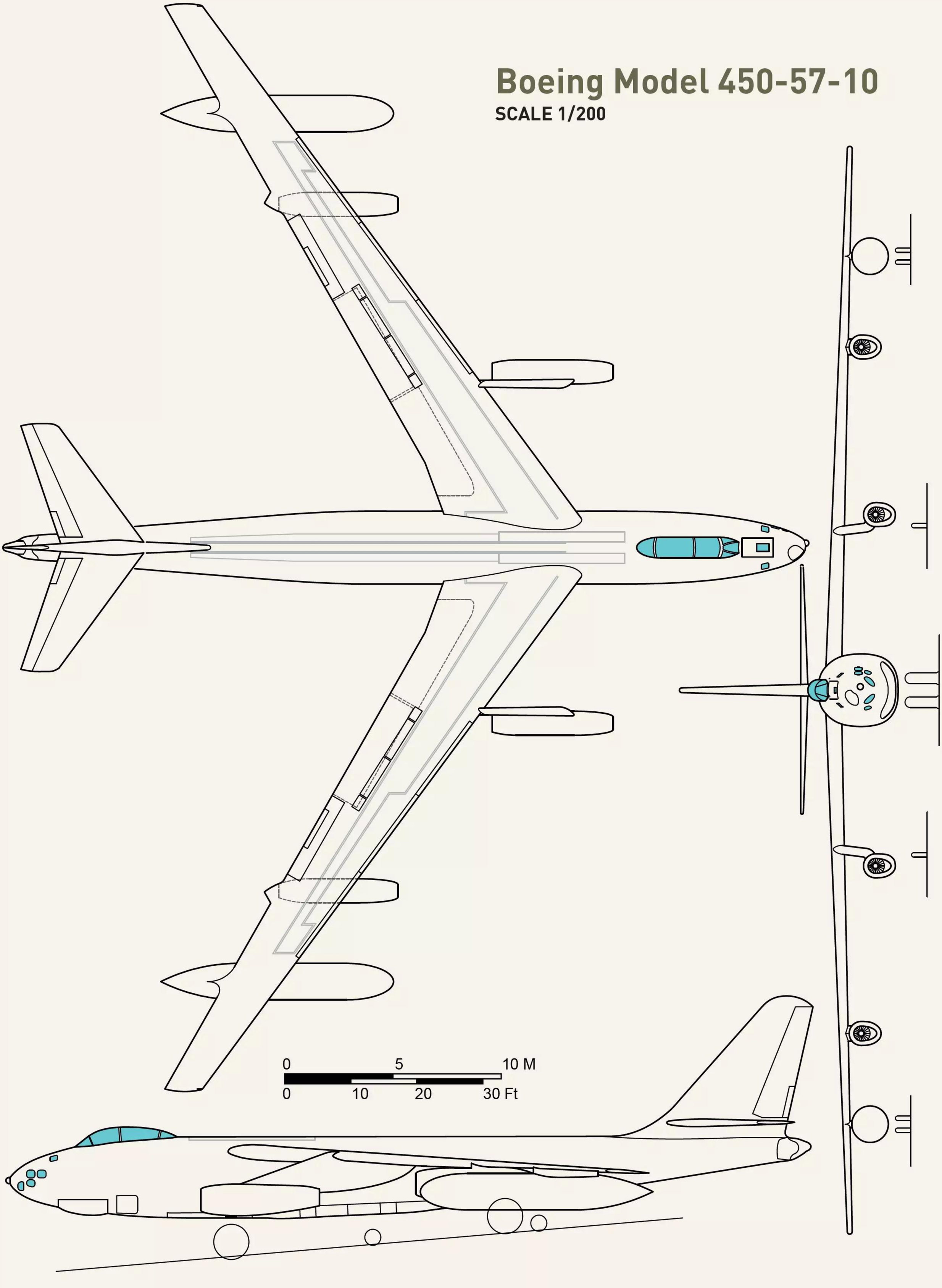


The experiments were built upon for project MX-1018, which involved attaching one Republic EF-84D jet fighter to each wingtip of an ETB-29A. Flight tests began in July 1950 and continued until April 1953 when one of the EF-84Ds, docked to the left wing of the ETB-29A, pitched up and rolled over onto the bomber's wing. The nose of the fighter and the outer wing of the bomber were sheared off and both planes crashed with a loss of all crew, ending the project. However, during the testing programme it was found that the jet fighters could reduce engine power to idle or even shut down entirely and the combination craft would still fly perfectly well. However, the system was intentionally never flown in rough air.

Beyond MX-1018 was 'Tom-Tom,' similar in concept but with two swept-wing Republic RF-84F fighters docked to the wingtips of a modified Convair RB-36F. This began flight testing in 1955 and continued into 1956, ending when one of the RF-84F's began 'flapping' violently, soon breaking the aircraft coupling mechanisms. In this case all aircraft were able to safely land, but the programme was terminated. Once again testing showed aerodynamic benefits for the B-36… and challenges for coupling in flight. The hope for 'Tom-Tom' was that it might prove sufficiently useful so as to enter service, providing two fighters to cover the B-36 on its long journey over enemy territory. How thrilled the fighter pilots would be to be stuck in their small cockpits for the better part of two days (the B-36 could stay in the air for around 40 hours) is not a detail that is well documented.

As these programmes were getting underway, the NACA was tasked with studying the concept of a B-36 with a B-47 attached to each wingtip. Who thought that attaching two B-47s to a B-36 was a good idea is a detail that seems to have been lost to time… perhaps the notion came from Boeing, perhaps Convair, perhaps the Air Force, perhaps someone at the NACA. In any event available design information is lean; it is not known if the original idea was just an off-handed notion or if someone was actually serous about it; but in any event the lone NACA document presents only the planform of the wings with no additional details.

The reconstruction shown here is thus provisional. It is shown with wingtip docking mechanisms taken from the Tom-Tom programme. For several reasons it is unlikely that this combination aircraft would have lifted off all hooked together. For starters, it can be seen that when level, the B-47s are raised high enough that their landing gear would not have reached the ground when the B-36 was still rolling down the runway. At low enough speeds the B-47s would have tilted far over, perhaps far enough to scrape their outboard wingtips on the ground. And there's the issue of the 462ft wingspan: there are few runways in the world wide enough to handle an aircraft with landing gear that widely spaced.

The probable purpose of this aircraft would be range extension for the B-47s, rather than for them to provide escort service for the B-36. The B-36 would fly about with the B-47s attached and idling their engines, milling about far from the US near Soviet airspace. Upon orders, the B-47s would detach and fly to their targets, their tanks full or nearly so, to penetrate deep into enemy territory. The B-36 would presumably then fly home. In this situation the B-36 would presumably swap out its own internal bomb load for more fuel tanks.

The crew of the B-47 could at least get up and move about, unlike the crews of the Tom-Tom F-84s. But even with that fantastic benefit, the idea seems to have existed for a very brief time.

Boeing Model 499-1

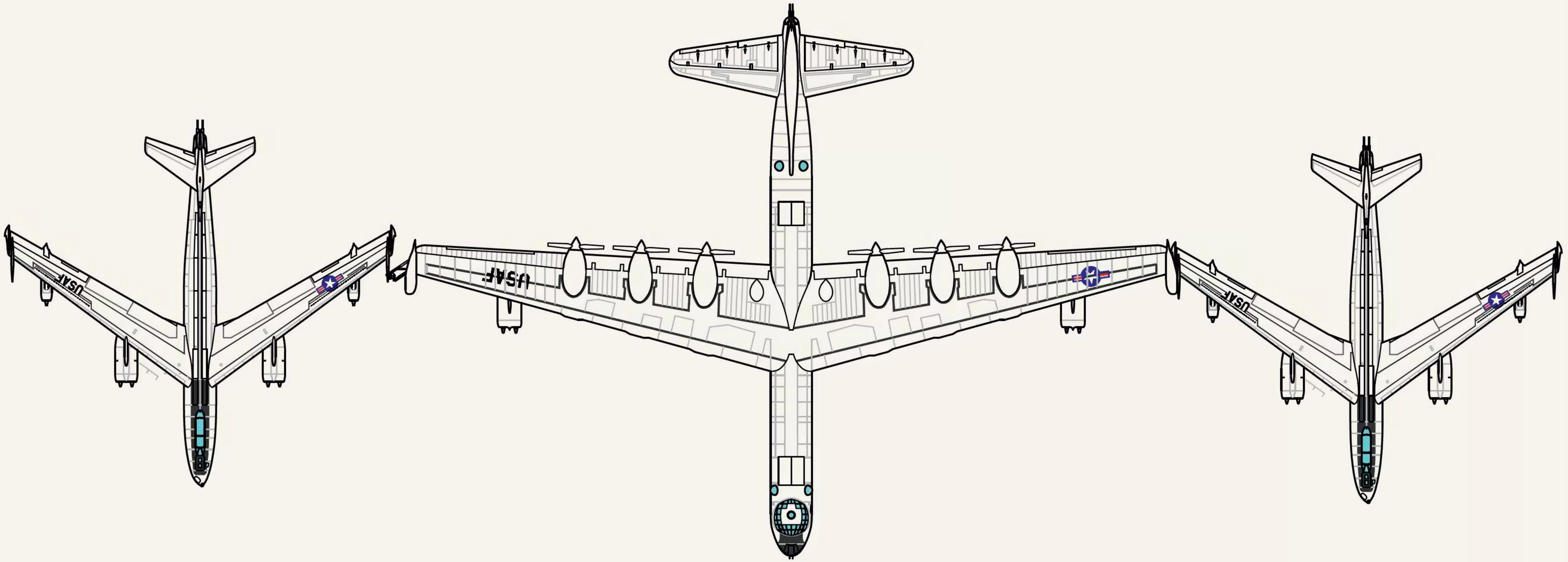
Poorly documented, the Model 499-1 from 1950 was a design for a tailless high altitude reconnaissance platform. The relationship between the Model 499 and the B-47 is somewhat tenuous, but it clearly shares design heritage with the shape of the forward fuselage, canopy, engine nacelles and wings. Performance data is currently lacking, but it doubtless would have exceeded the B-47's altitude capabilities. It equally doubtless would not have equalled the altitude performance of the later Lockheed U-2 recon plane, but the payload it carried, four sizable film cameras in the rear fuselage, would have been far greater than the U-2's payload. While not a bomber, it had several crewmen in positions reminiscent of bombardiers; with a crew of five, the workload would have been spread out.

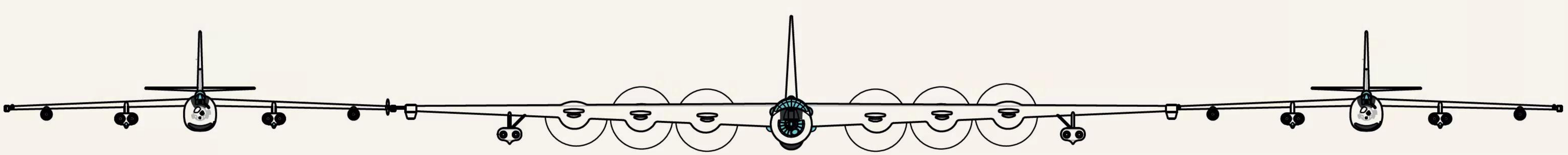
The tailless configuration of the Model 499 was quite unusual for Boeing, which had not made a great many tailless or flying wing designs. With some imagination and blending of surfaces, the overall shape of the Model 499-1 would fit well today as a high altitude unmanned stealthy recon drone.

Nuclear powered B-47

As described in *US Aviation Secret Projects 2: B-52 Stratofortress*, from the 1940s into the 1960s the United States military was fascinated by the notion of atomic-powered aircraft. On paper the idea is fantastic… a nuclear reactor can in principle provide enough power to propel an aircraft, and can do so effectively indefinitely. To make best use of this technology the aircraft should be designed from the ground-up to incorporate the many, many unique systems and inherent limitations; but in order to prove out the technology, existing aircraft were proposed as early testbeds. One of the aircraft proposed was the Boeing B-47.

In September 1952 the NEPA (Nuclear Energy for the Propulsion of Aircraft) Division of the Fairchild Engine and Aircraft Corporation reported on a series of preliminary – mostly very preliminary – designs for nuclear powered aircraft. Included were clean-sheet





Convair B-36 + Boeing B-47 Wing Tip Tow

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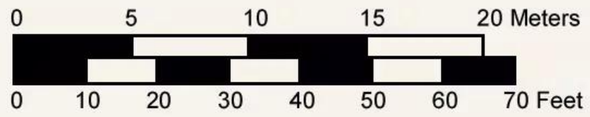

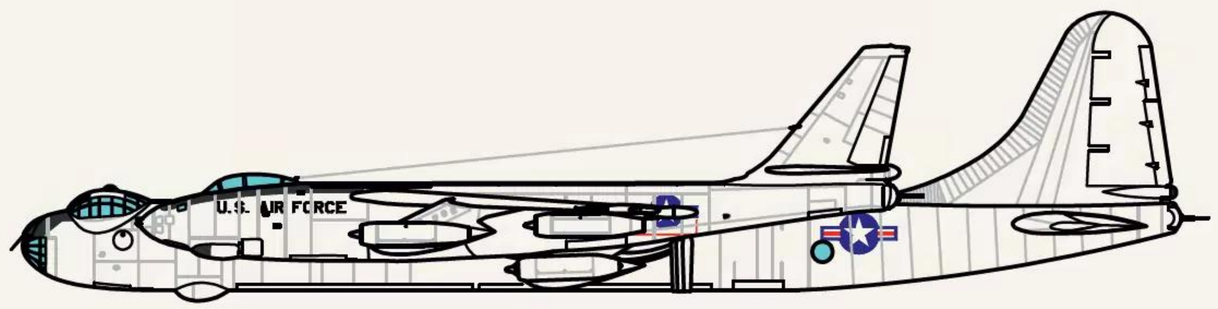

Boeing Model 499-1
Long Range High Alt Recon

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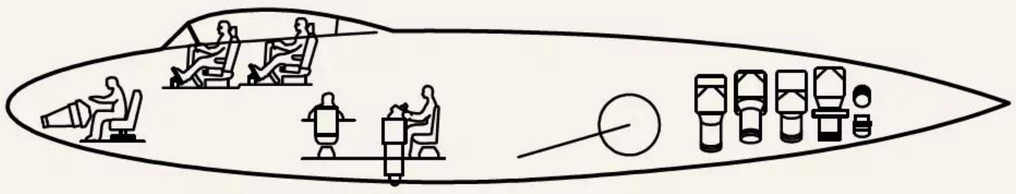
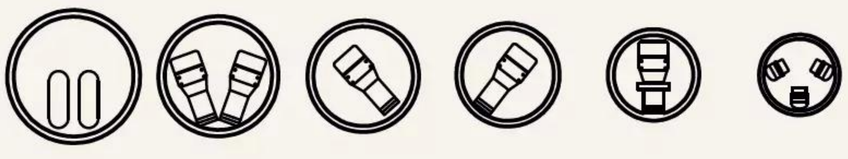
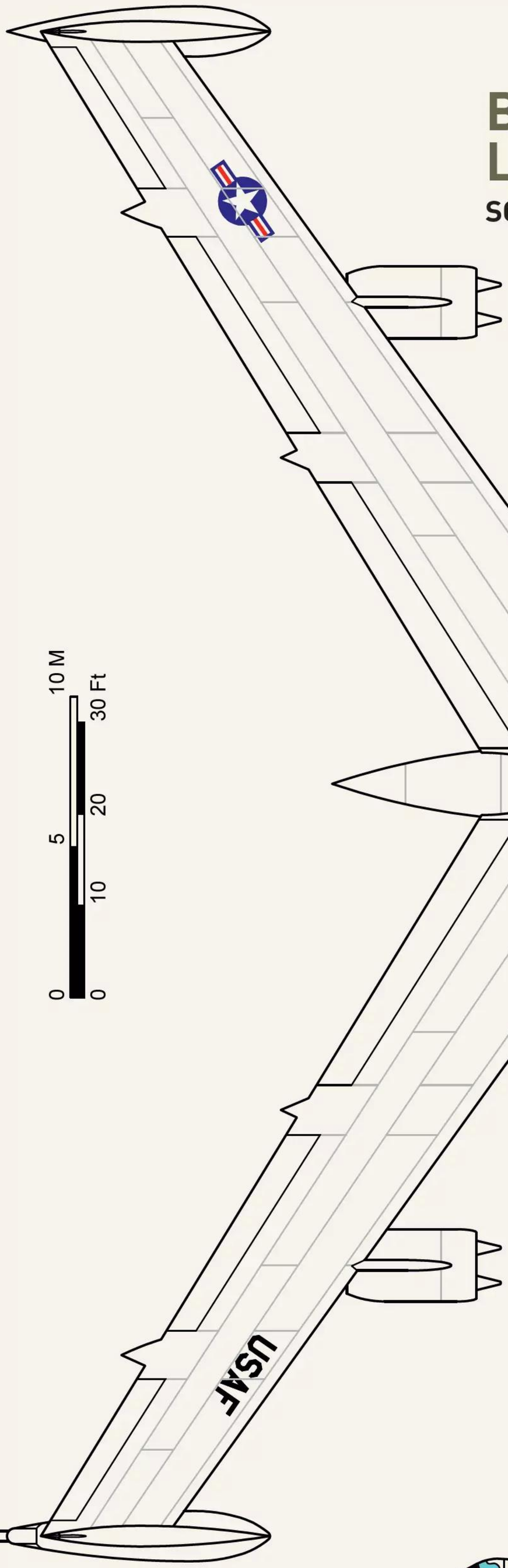
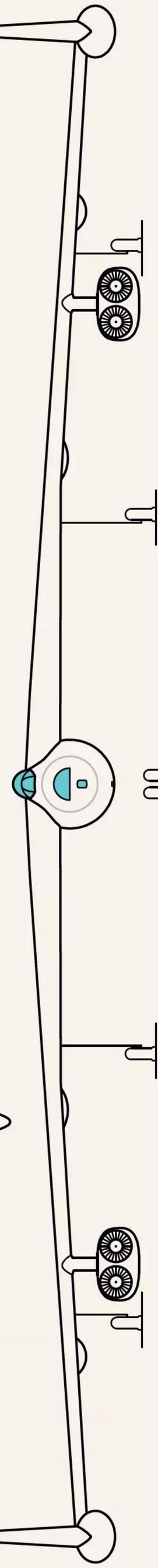
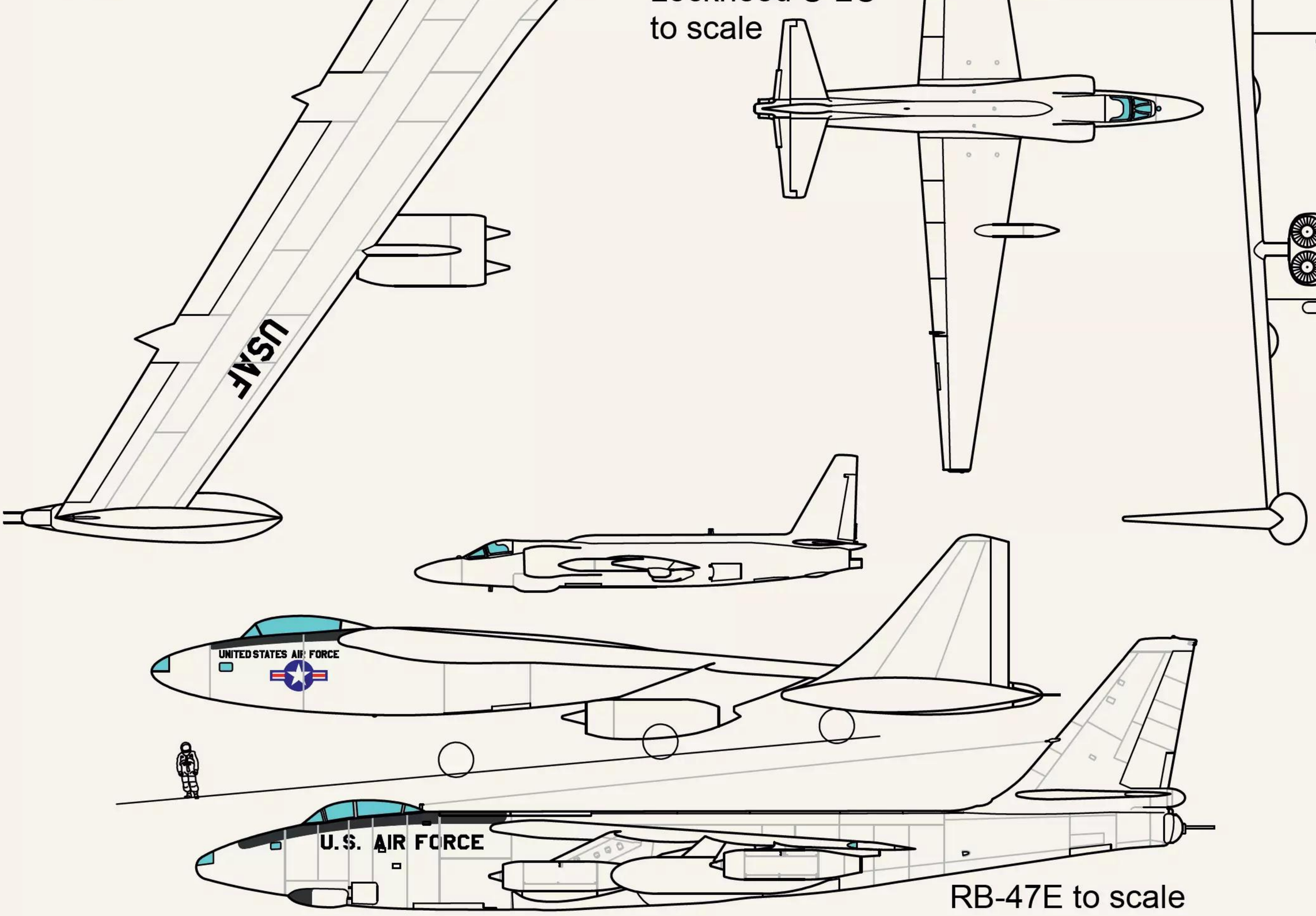








Lockheed U-2C
to scale



RB-47E to scale

Nuclear B-47

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UNITED STATES AIR FORCE

designs as well as modified B-52s, B-36s and C-99s. But also in the list were two B-47 concepts, designated N-19 and N-20. Data for the B-47 designs seems to be purely back of the envelope with no apparent engineering design work; however, a single sketch is available to roughly illustrate what they came up with. The N-19 and N-20 designs seemed to differ only in the type of nuclear reactor they would carry: the 'L-14-4' reactor for the former and the 'L-17-4' for the latter. In both cases the reactor would be installed within the aft bomb bay; they would provide power to the engines via 50ft-long 'coolant pipes'. The engines would consist of four new XJ-53 turbojets modified for nuclear power, as well as chemical burning.

The L-14-4 had a heat output of 100,000 BTU/sec (10.55 megawatts). The reactor itself weighed 38,000lb and required a 23,500lb crew shield. The L-17-4 had a heat output of 183,000 BTU/sec (19.3 megawatts). The reactor weighed 46,000lb and needed a 25,000lb crew shield. In well-developed nuclear aircraft designs, the crew are contained within a heavily shielded cockpit-capsule with incredibly thick window typically just barely big enough to see out of. The sketch for the atomic B-47, however, shows the stock canopy. Almost certainly this would have been replaced, the crew perhaps moved downwards and located within a nearly completely faired-over and sealed-in fuselage with small windows or periscopes to see through.

The nuclear reactor was to be sealed off from the environment, with no directly radioactive components coming into contact with the air. In order for the reactor to provide power to the engines, a first loop of liquid metal – sodium – would be passed through it, taking heat from the reactor core. The loop would be short, promptly passing through a heat exchanger; the sodium would give up its heat to a second loop of liquid metal, in this case lithium. The superheated liquid lithium would be piped through the wings to the engines, running through another heat exchanger in what would normally be the combustion chamber(s) of the jet engine. There it would dump its heat to the air downstream of the compressors. The hot, pressurised air would blow by the turbines, powering the engine, and out through the nozzle, generating thrust. This system would, ideally, prevent any radioactive materials from getting out of the aircraft.

While a great theory, the B-47 was a small aircraft. This limited the number of engines that could be used as well as the power that could be generated, but it did little to reduce the weight of the reactor and associated shielding. As a result the nuclear B-47 was very low powered, with performance that was at best dubious. For example, the N-19 had a maximum rate of climb at sea level on pure nuclear power of a mere 37ft per minute; the N-20 was substantially better at 2000ft per minute… but with chemical augmentation it could attain 6420ft per minute.

The B-47 was effectively immediately dropped from consideration in the atomic aircraft effort. Not, of course, that any other aircraft ended up doing any better. When the programme was cancelled by President Kennedy, no aircraft had flown under nuclear power, and no aircraft were close to it. Today, it seems that the Russians may have achieved that goal with their 9M730 Burevestnik, a cruise missile reputed to have a nuclear powerplant. This is yet to be independently confirmed.

B-47 gunship

One interesting but poorly documented notion was a Viet Nam era proposal to turn the B-47 into a gunship. By this point the B-47 was obsolete, retired and taking up space in the Davis-Monthan boneyard. But for some applications such as the previously described WEARY WILLIE II notions, the B-47 airframe was still applicable. So the idea by Boeing and Emerson Electric Company engineers was to take four of the latter company's TAT 161 turrets, each equipped with an M61 Vulcan 20mm Gatling gun, and attach them to a structure protruding from the aft bomb bay. At 6,000 rounds per minute per gun, this means a three second burst would send 1,200 20mm projectiles zinging towards some unfortunate dope in the jungles of Viet Nam (or Laos, or Cambodia, or wherever else the US military wasn't at the time). The crude diagram illustrating this concept did not depict any additional hardware such as flare launchers, high intensity spotlights, IR cameras, low light TV or any other electro-optical systems needed to aim the weapons, but it's safe to assume than any B-47 gunship would have had them, either built into the nose or hanging off the wings.

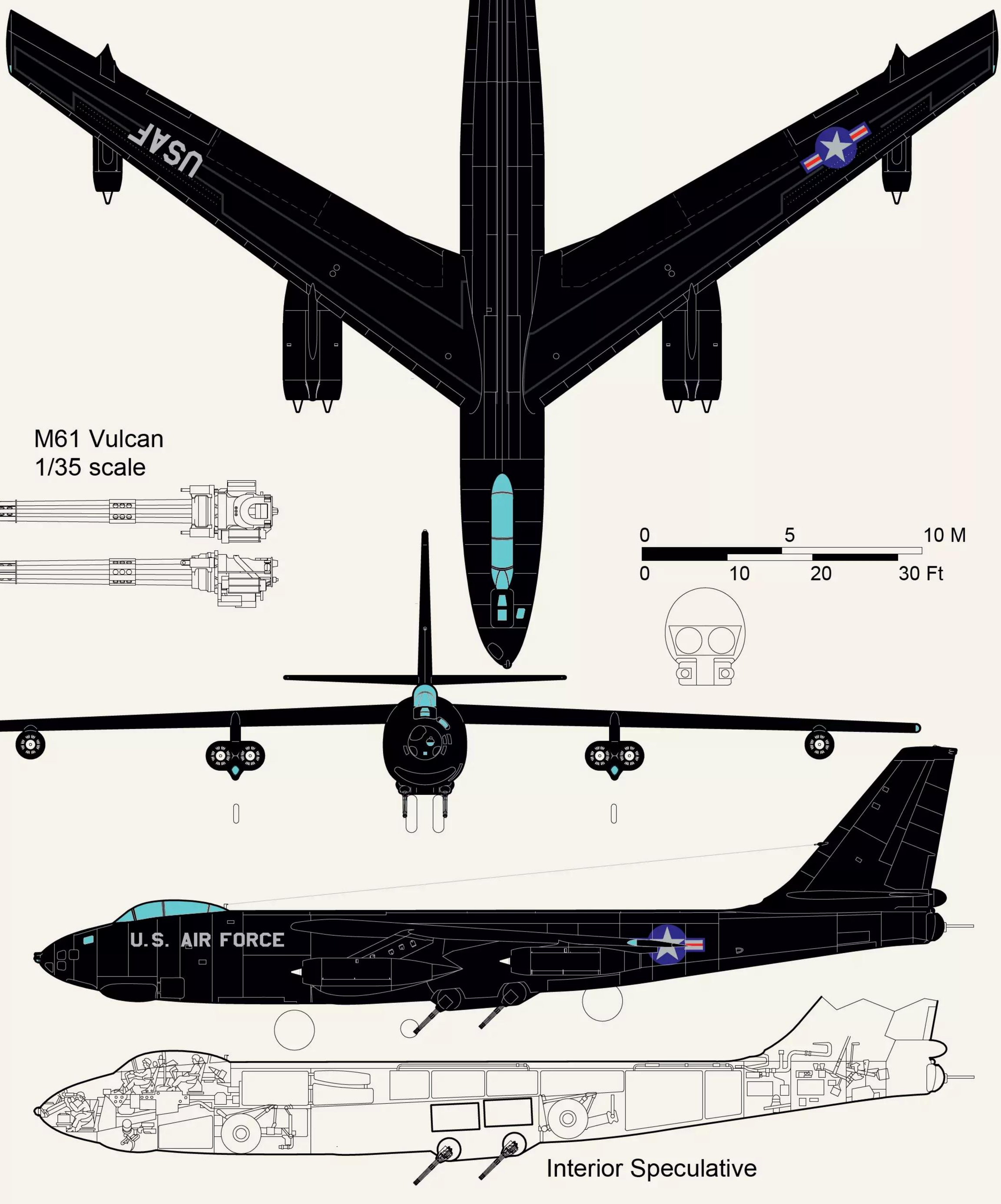
In the late 1960s a single RB-57G was modified under the 'PAVE GAT' programme for a single Emerson TAT 157 or TAT 161 turret. Testing carried out in 1969-1970 showed that the system was practical, firing specially made arrowhead-like flechette rounds designed to cause maximum damage to softer targets such as trucks. Both day and night tests showed that the airborne sensor-slewed 20mm gun could bullseye as many as 20 targets with 4,000 rounds. The ability to fire offset allowed the aircraft to fire at some distance and not have to directly overfly the target. A dedicated B-47 gunship armed with an operational four-gun version of the system could well have been a nightmare to enemy forces without adequate air defences.

The illustration here depicts the B-47 gunship in an all-black 'night intruder' colour scheme similar to that worn by Martin B-57s in Viet Nam. The illustration also moved the turret assembly forward slightly from the original diagram… which had the system built partway into the aft landing gear bay.

Nuclear B-47E Gunship

SCALE 1/200

Speculative Night Intruder Paint Scheme



M61 Vulcan
1/35 scale

0 5 10 M
0 10 20 30 Ft

Interior Speculative

4 CHAPTER

B-47 Derived Transports

Through World War II there had been a large number of cases where bombers were turned into transport planes, and transport planes turned into bombers. The pre-war Germans were masters of this; famed wartime bombers such as the Heinkel He 111 and Dornier Do 17 started off as transports. They were not very good airliners; they were, however, the best airliners that could be hammered out of aircraft that were intended from the beginning to violate the terms of the Treaty of Versailles.

Boeing was quite familiar with turning bombers into transports. Several B-17s were modified into various transports including the C-108 and CB-17; several B-17s impounded in Sweden during the war were similarly converted. However, these were modest modifications to the existing airframe, poorly optimised for passenger or cargo transport. More important was the Model 307 Stratoliner, an airliner made by adding an entirely new and much more voluminous fuselage to the wings and tail of the B-17. The fuselage was of circular cross section and was the first airliner to be pressurised for flight above most of the weather, providing a much smoother and more comfortable flight for the passengers. The advent of the Second World War curtailed mass production, and only ten examples were built.

After the war, the B-29 was looked at for the role of transport, and eventually emerged as the Model 367-1-1, better known as the C-97 Stratofreighter. As with the Model 307, the Model 367 used the wings, engines and tail of the B-29 were used; unlike the Stratoliner, the fuselage of the B-29 was to some degree retained. A larger diameter cylindrical fuselage was built atop the existing fuselage, creating a 'double bubble' configuration. The C-97 was much more successful than the Stratoliner; nearly a thousand of the military C-97 freighter (and subsequent KC-97 tanker) and more than 50 of the Model 377 Stratocruiser dedicated commercial passenger liner were built.

In the immediate post-war years, the Stratoliner (first flight in 1947) seemed quite advanced. But Boeing knew that eventually jet propulsion would come to passenger transports. An obvious starting point for the design of the next generation of jet airliner would be to start with the jet bomber then under development: the B-47. It is perhaps interesting that while Boeing created a number of designs for jetliners based in large part or small on the B-47 and B-52, it never seemed to design a simple conversion of the bombers into jetliners, but instead only took general design ideas. And in the end, no cargo or passenger transport was ever created from either the B-47 or the B-52.

Boeing's initial efforts to develop a turbojet-powered airliner fell under the Model 473 designation. Initially the Model 473 designs took inspiration from the contemporary B-47, but eventually switched over to the B-52. Most of the designs seem to have been studied only briefly. The early Model 473 designs were generally simpler and less elegant than the B-47 but the general configuration was retained. Even though designed all the way back in June 1947, the basic layout for virtually all successful jetliners was already established. Apart from having a high shoulder-mounted wing, as opposed to the more usual low-mounted wing, the earliest Model 473 designs would not look out of place on modern airfields.

The Model 473 design series did not directly result in an actual aircraft being constructed. Boeing's first jetliner, the 707, was derived from the Model 367-80 (better known as the Dash 80) prototype. The Model 367 series was a separate design programme from the Model 473, but for a good long while the two ran parallel to each other. In the end, the Model 473 studies diverged from the B-47 and B-52 and became wholly their own designs, trending towards and converging with the Model 367.

Boeing Model 473-10

The first of the Model 473 configurations known from diagrams is referred to simply as 'Model 473,' though the data seems to indicate that this is perhaps the Model 473-10. The Model 473-1 was, based on data, similar in configuration but with smaller wings, and some references indicate that it dates from sometime in 1946.

There were a few features that would set the Model 473-10 from June 1947 apart from modern jetliners from a visual standpoint. The basic layout common to airliners that would be designed for the next three quarters of a century – and likely much longer – were already established. The configuration was clearly not simply a modified B-47, but it did bear many similarities. The Model 473-10 was noticeably smaller than the B-47 in all respects.

Boeing Model 473

SCALE 1/180

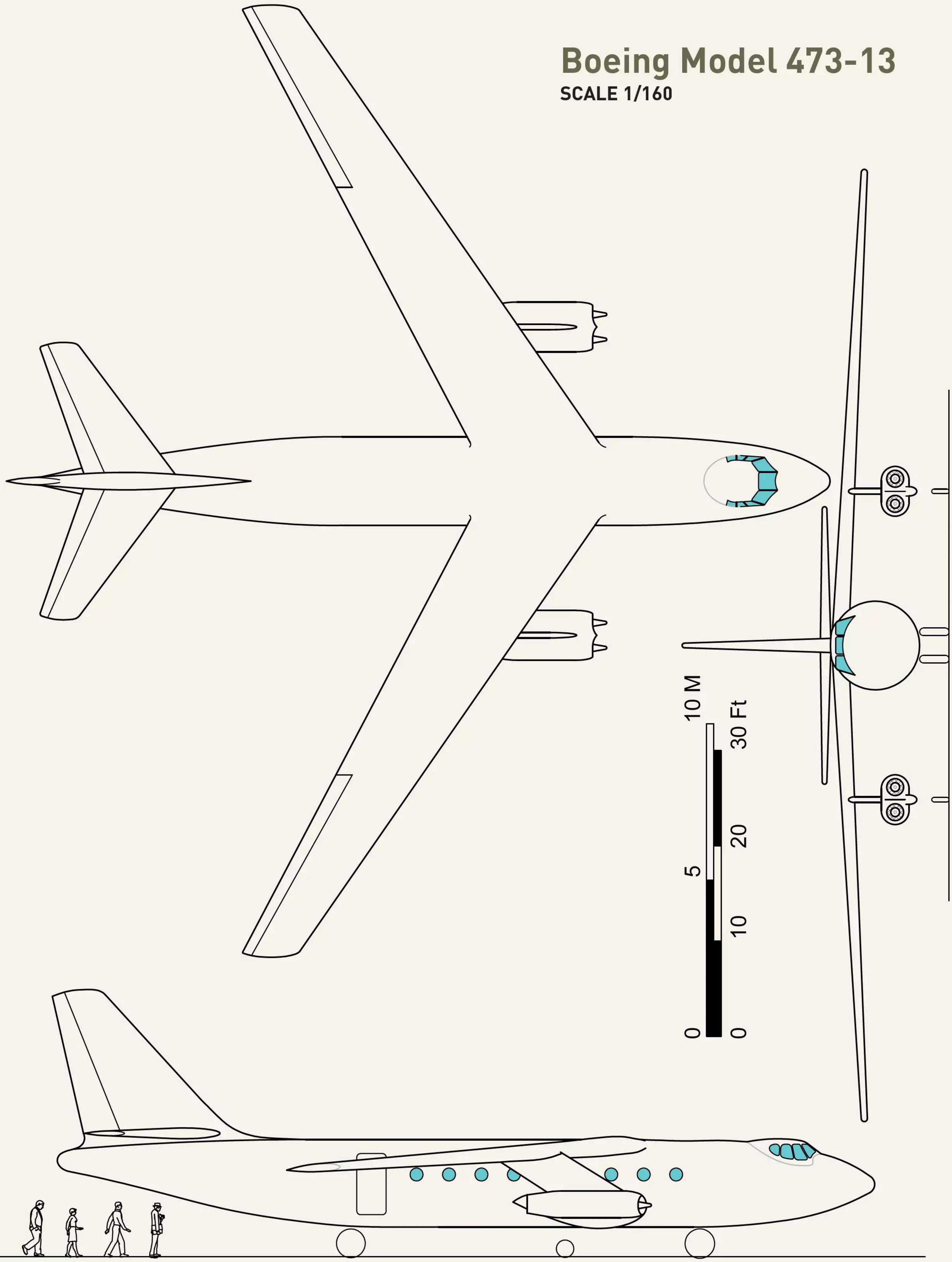
0 5 10 M

0 10 20 30 Ft

B-47B to scale

Boeing Model 473-13

SCALE 1/160



The fuselage was a circular cross-section cylinder with a fairly blunt nose and a gradually tapering tail. The two-seater cockpit canopy was quite expansive and flush with the blunt forward fuselage contour. The canopy itself was composed of a large number of individually framed windows providing a wide field of view. The landing gear used the B-47's 'bicycle' configuration, with two sizable twin-wheel bogeys, one fore, one aft, with small outrigger gear below the engine pods. The main landing gear was stowed entirely within the cylindrical outer lines of the relatively narrow (100in diameter, though the data calls for 122in) fuselage, meaning that the landing gear bays intruded into the confines of the pressurized passenger compartment.

Somewhat oddly, the main gear was offset to starboard in the fuselage; this was done to provide space for crew/passenger passage in the otherwise rather cramped fuselage. The Rolls-Royce Nene turbojets, each capable of producing 6,000lb of thrust, were individually suspended from the wings by pylons; small outrigger gear would deploy from the undersides of the nacelles. The wings were mounted high, the spars passing above the fuselage. While an unusual feature for jetliners today, shoulder mounted wings are not unknown, as the BAe 146 can attest. Wings are typically mounted low so that the landing gear can be stowed partially or completely within the wings, without intruding into the fuselage as was necessary on the Model 473-10.

Seating consisted of nine rows in a 2+1 layout, though data calls out 28 total passengers. Crew of three included one steward. The description called for "high speed" and "long range," but unfortunately performance details are currently lacking.

Boeing Model 473-13

The Model 473-13 (data from July 1948, but the design is possibly from some time earlier) was a four-engine configuration clearly derived from the 473-10. The layout was closer to that of the B-47 with two twin-engine B-47-style nacelles and a larger fuselage. The four engines were located in two dual-engine nacelles much like those of the inboard nacelles of the B-47.

The Model 473-13 could carry 36 passengers in nine rows of four with a central aisle. The wings of the 473-13 were set somewhat lower on the fuselage than those of the 473-10, while the cockpit canopy was raised and more conventional for the time, reasonably closely resembling the raised cockpit of the Model 464-17. As with the 473-10, the landing gear was of bicycle arrangement (located along the centreline, not shifted to the side) with small outriggers below the engine pods. The Model 473-13 was, apart from the twin-jet nacelles, closer still to the modern conception of the jetliner.

Boeing Model 473-14

Model 473-14 was quite similar to the 473-13 in general configuration, but with important changes. The wing was given less sweepback; sizable external fuel tanks were attached to the underside of the outer wings. The fuselage was slightly curvier and more rotund and had room for four additional passengers. The horizontal stabiliser was moved slightly upwards onto the vertical stabiliser and was reduced slightly in size, made possible by locating it slightly further aft. Passenger seating was in ten two-by-two rows.

Model 473-14 retained the landing gear arrangement of the prior models, but featured a somewhat more conventional nose gear that folded up under the cockpit. The main aft gear retracted into a well within the rear of the pressurized cabin.

Boeing Model 473-14N

The Model 473-14N was a minor modification of the -14 into a cargo transport. This was done by the simple expedient of leaving out such passenger comforts as seats and windows and installing large cargo loading doors at fore and aft on the port side of the fuselage.

Boeing Model 473-23

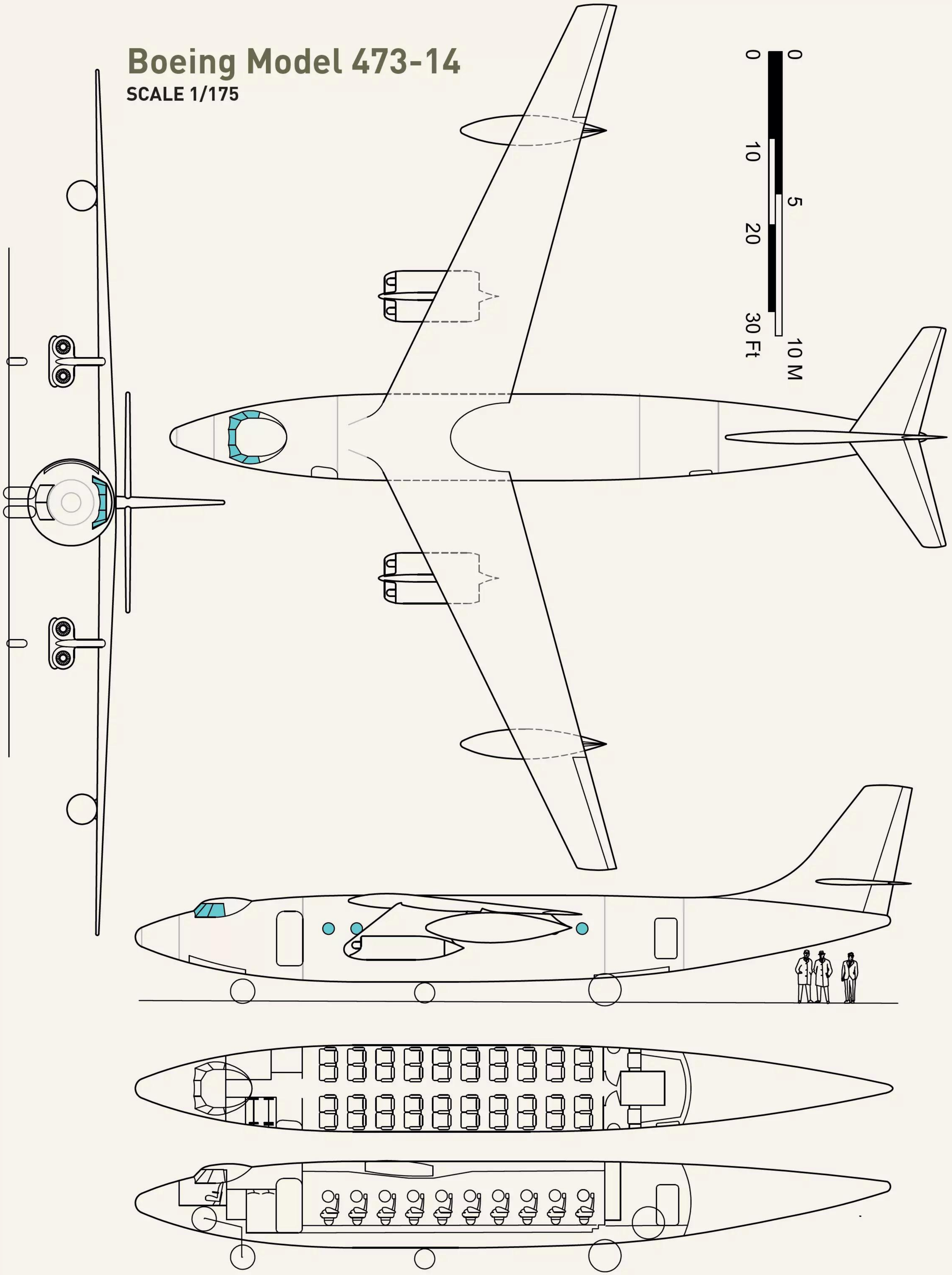
Model 473-23 was the same basic configuration but scaled up slightly, with the same basic passenger load. This was to be a non-stop transatlantic airliner, certainly an ambitious goal for a jet powered aircraft designed in April 1949. In order to fly its 36 passengers more than 5,000 miles, the Model 473-23 had fairly gigantic external fuel tank pods suspended beneath the inner wings. The dual-engine pods – now fitted with the same J57s that powered the B-47, were moved well outboard, an arrangement certain to cause thrust imbalance headaches in the event an engine goes out.

Boeing Model 473-27/-28

The Boeing Model 473-27 and -28 of May 1949, were more or less the same aircraft, the only difference being that the -27 was a troop/cargo transport while the -28 was a jetliner. The overall configuration was much like that of the Model 473-23, including the far-outboard dual-engine nacelles and the large inboard fuel tanks. One noticeable advancement was incorporation of the thicker wing inboard section, a design detail that was one of the secrets of the B-52's success. This would also come in handy for jetliners; when the wings moved down to the bottom of the fuselage, rather than the top (as was still the case with the Model 472-27/-28), the thicker wing inboard sections gave volume for the landing gear to partially or entirely fold into, allowing the pressurized passenger cabin to not have to accommodate wheel wells.

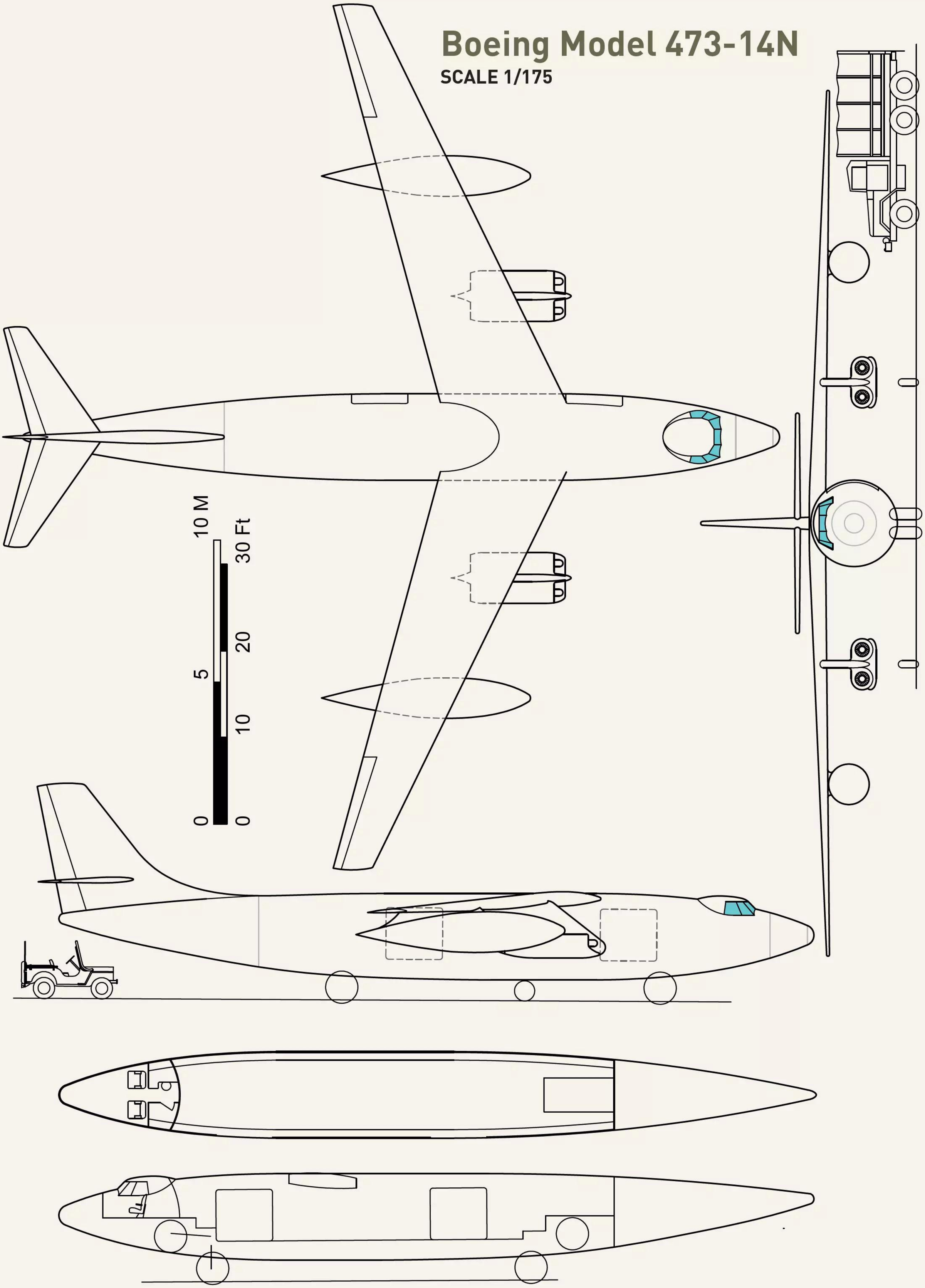
Boeing Model 473-14

SCALE 1/175



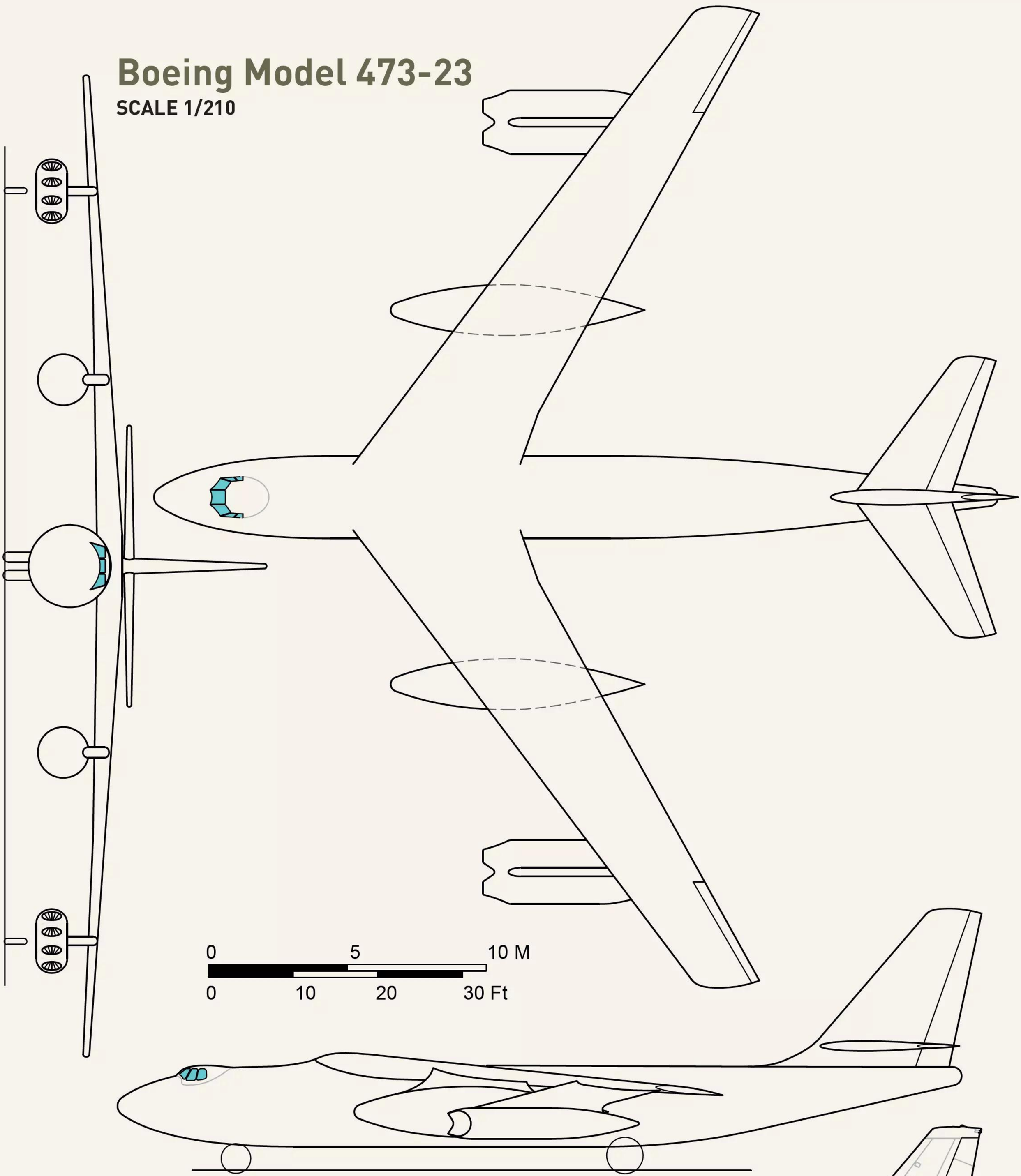
Boeing Model 473-14N

SCALE 1/175

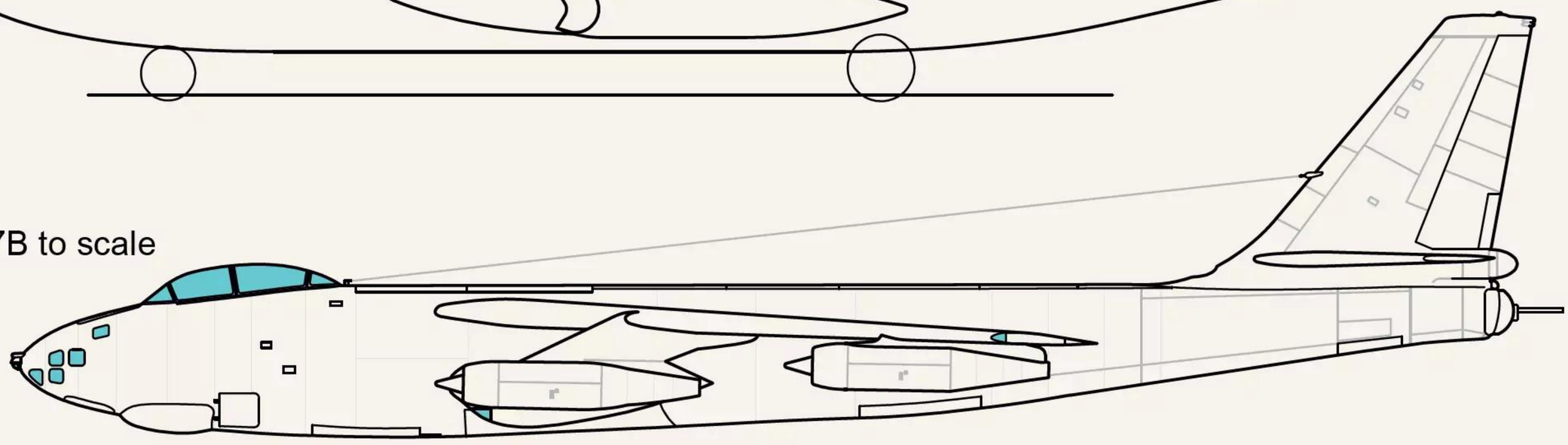


Boeing Model 473-23

SCALE 1/210



B-47B to scale



Boeing Model 473-27/28

SCALE 1/190

0 5 10 M

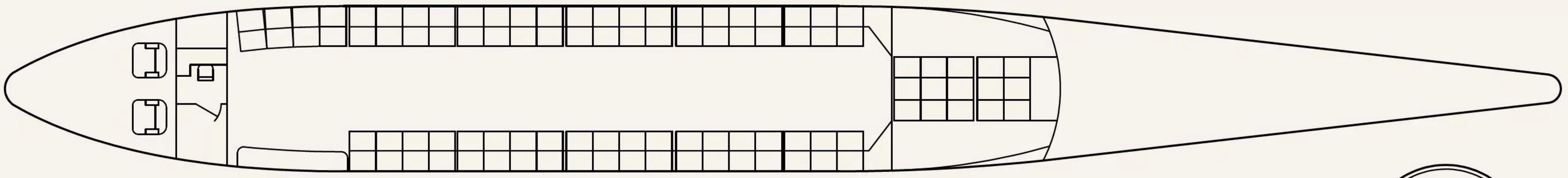
0 10 20 30 Ft

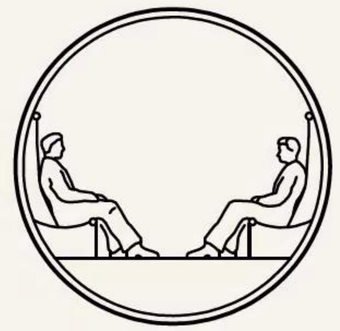
Model 473-27 Troop Transport

Model 473-28 Jetliner

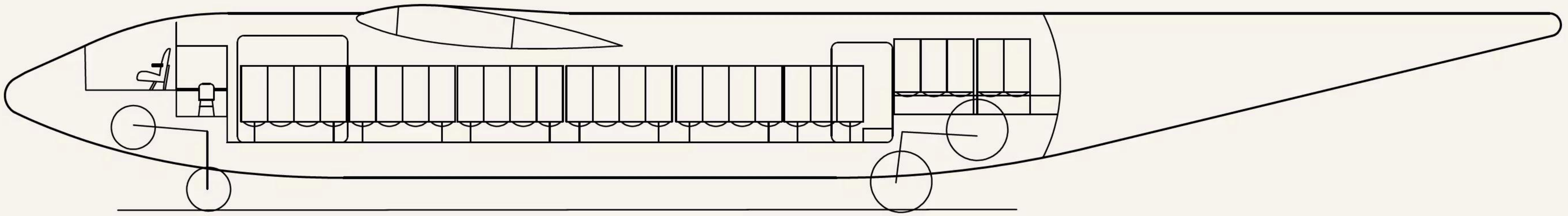
Boeing Model 473-27/28

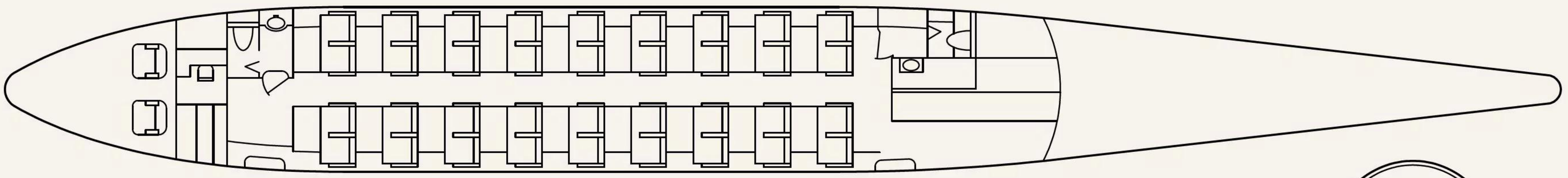
SCALE 1/125

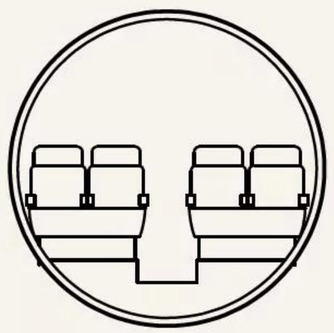




Model 473-27 Troop Transport



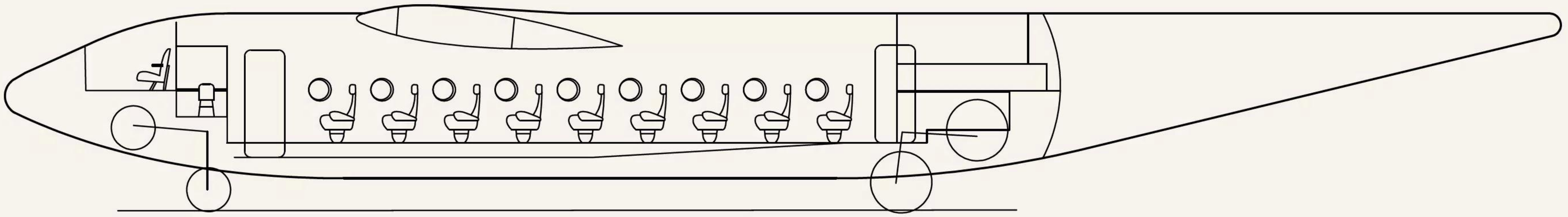




Model 473-28 Jetliner

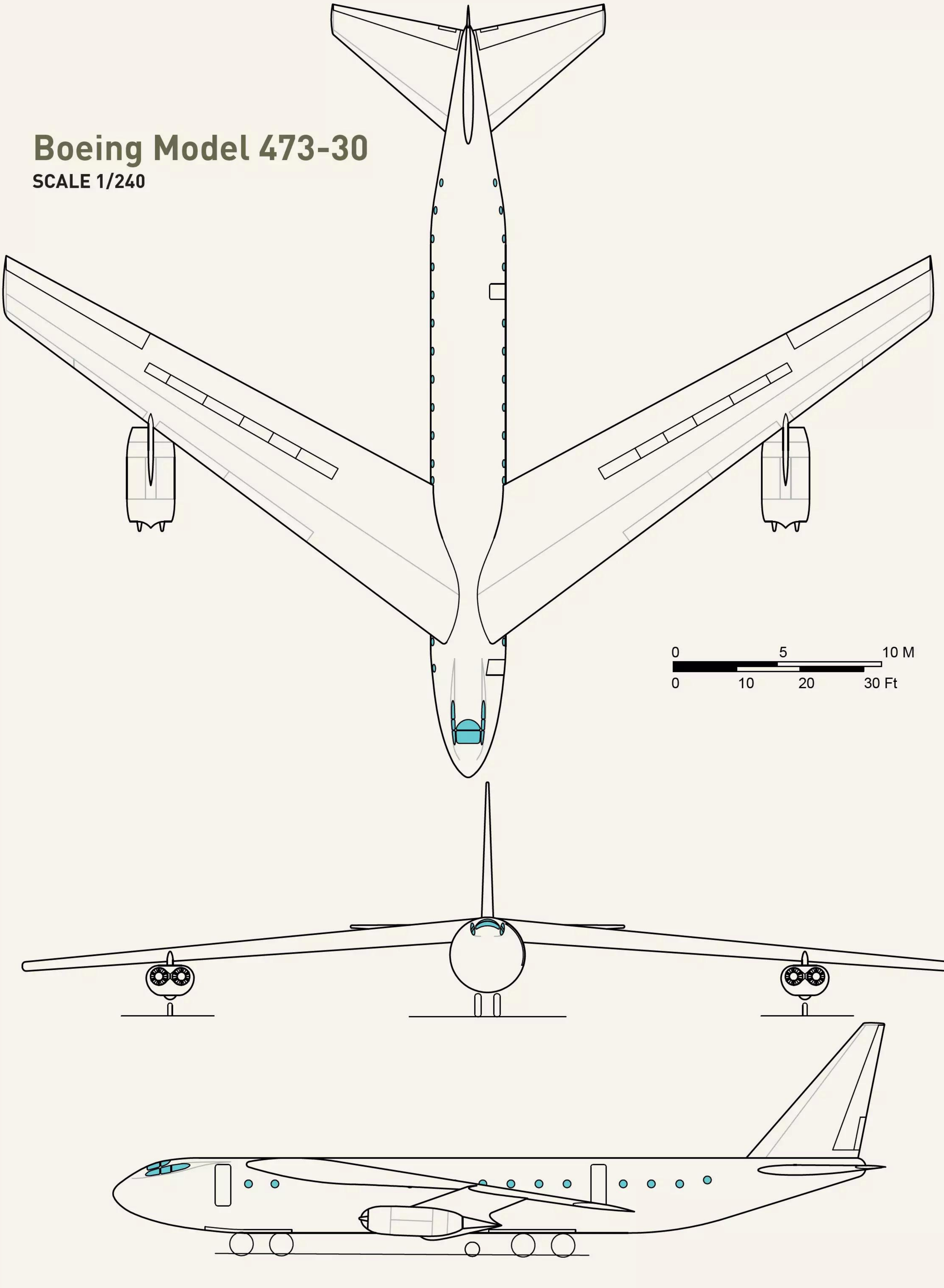
0 5 10 M

0 10 20 30 Ft



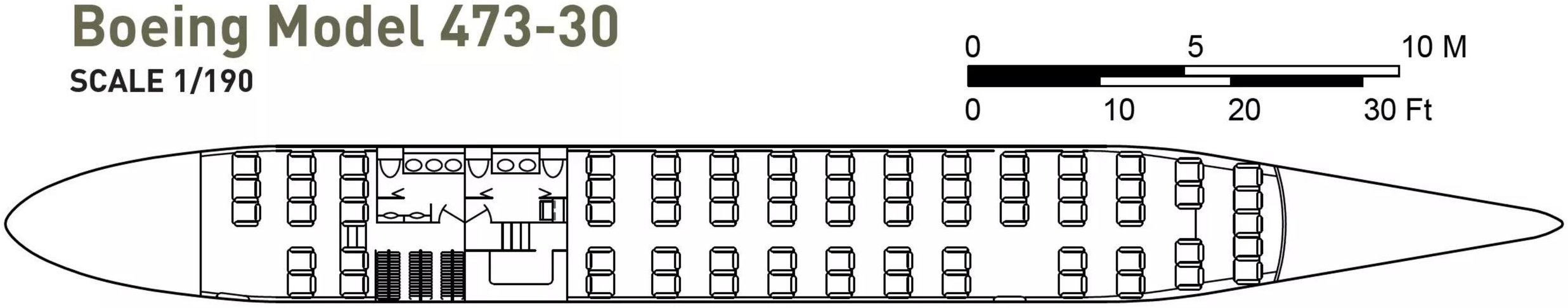
Boeing Model 473-30

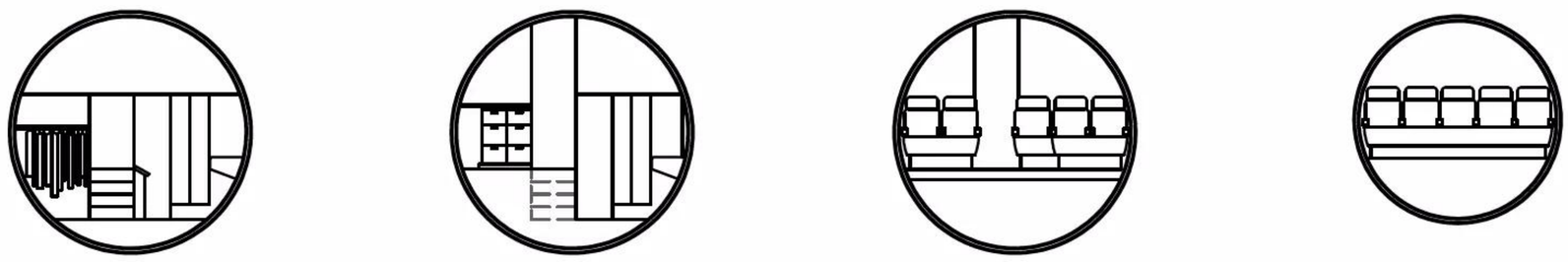
SCALE 1/240



Boeing Model 473-30

SCALE 1/190





The Model 473-27 had seating for 52 troops, most in seats with their backs to the 120in diameter fuselage walls. This left a substantial free space down the centre. It's not clear if the Model 473-27 was meant simply to fly troops form one airfield to another or if it was to open its door in flight and expel paratroopers, but it was equipped with two doors on the port side: a standard size door at the rear of the passenger compartment and a larger door just aft of the cockpit. That door would be used for the loading of cargo as well as troops. Presumably the troop seats would fold up against the wall to maximize cargo volume.

The Model 473-28 airliner had rather more comfortable seating for 36 passengers. The Model 473-27 had an additional 5,000lb of fuel capacity and some 15,000lb greater gross weight than the passenger liner.

According to concept art, both versions had the same rather unusual canopy arrangement over the cockpit, while the available diagrams depict, rather simply, a canopy similar to earlier Model 473 designs. The odder, more interesting canopy is reproduced here.

Boeing Model 473-30

This configuration from June 1949 was similar to that of Model 473-28, though stretched in all dimensions and stripped of the external fuel tank pods. With a fuselage 11.8ft in diameter, it could carry 70 passengers a considerably greater distance, though was perhaps not quite transatlantic. While the configuration was largely in line with the Model 473's that had gone before it, it had something of a blunt angularity to it, with an 11.8ft diameter cylindrical fuselage with a relatively short tail cone. Here at last was a B-47-sized airliner where the top surface of the wing was actually below the top surface of the fuselage. Along with wingtip ailerons, the wings had an extensive series of spoilers. With the wings anhedral and the far outboard position of the nacelles, the deployable outrigger gear were quite short.

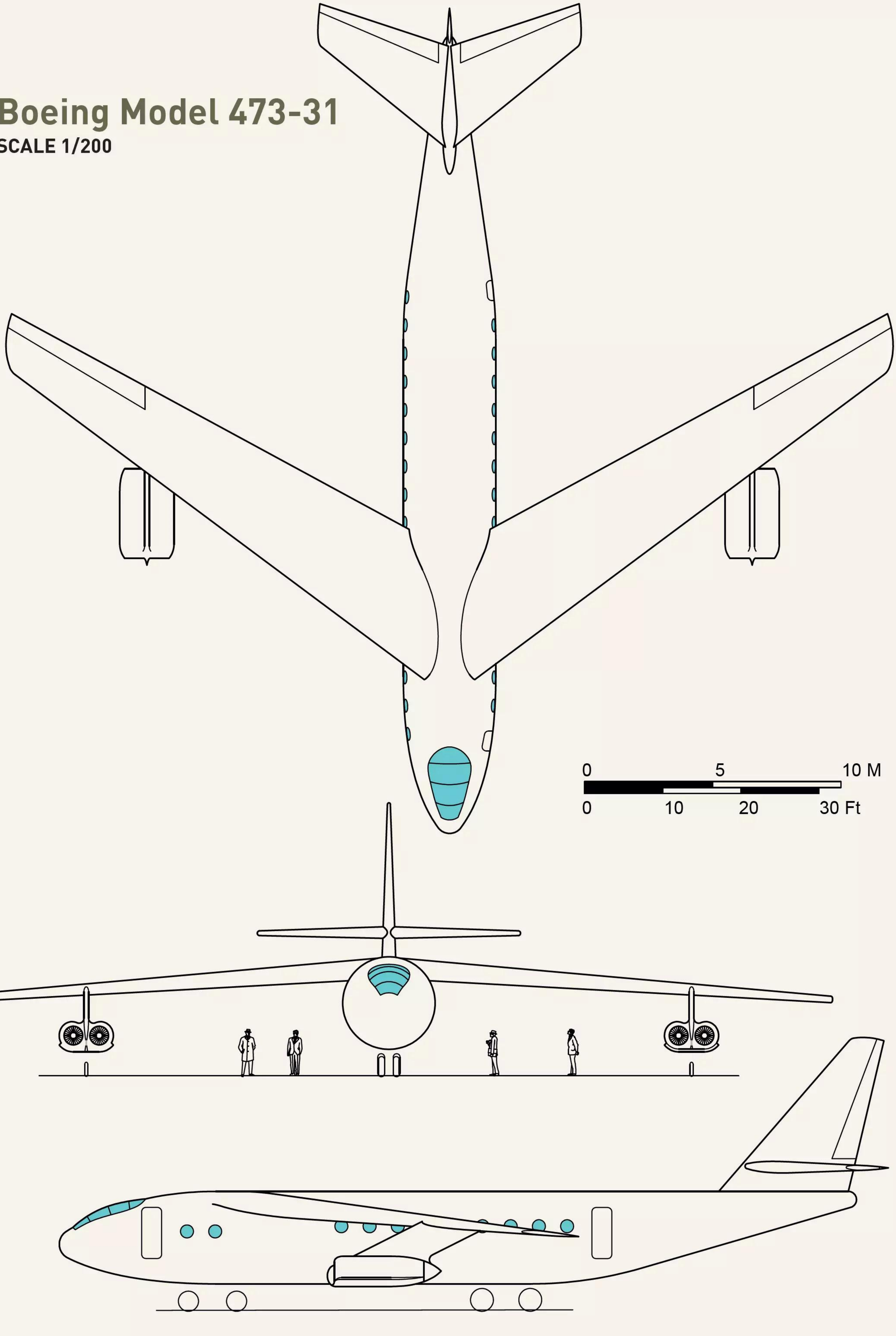
Boeing Model 473-31

The Models 473-31, -32 and -33 of July 1949 were the last of the series that bore a distinct resemblance to the B-47, and the resemblance was fading fast. The realities of passenger transport requirements began to draw the design series further and further away from the B-47 and towards what would become the 707.

The Model 473-31 was smaller than the preceding design and correspondingly had a smaller passenger load, 61, and a much shorter range. The fuselage diameter was the same but was 11ft shorter. The configuration was much the same as the Model 473-30, though the cockpit canopy – depicted only in the side view, unfortunately – appears to have been different. The -32 and -33 had differences in engines and dimensions, but were visually distinct largely in that the -32 had a small external fuel tank under the wing and the -33 had a large one.

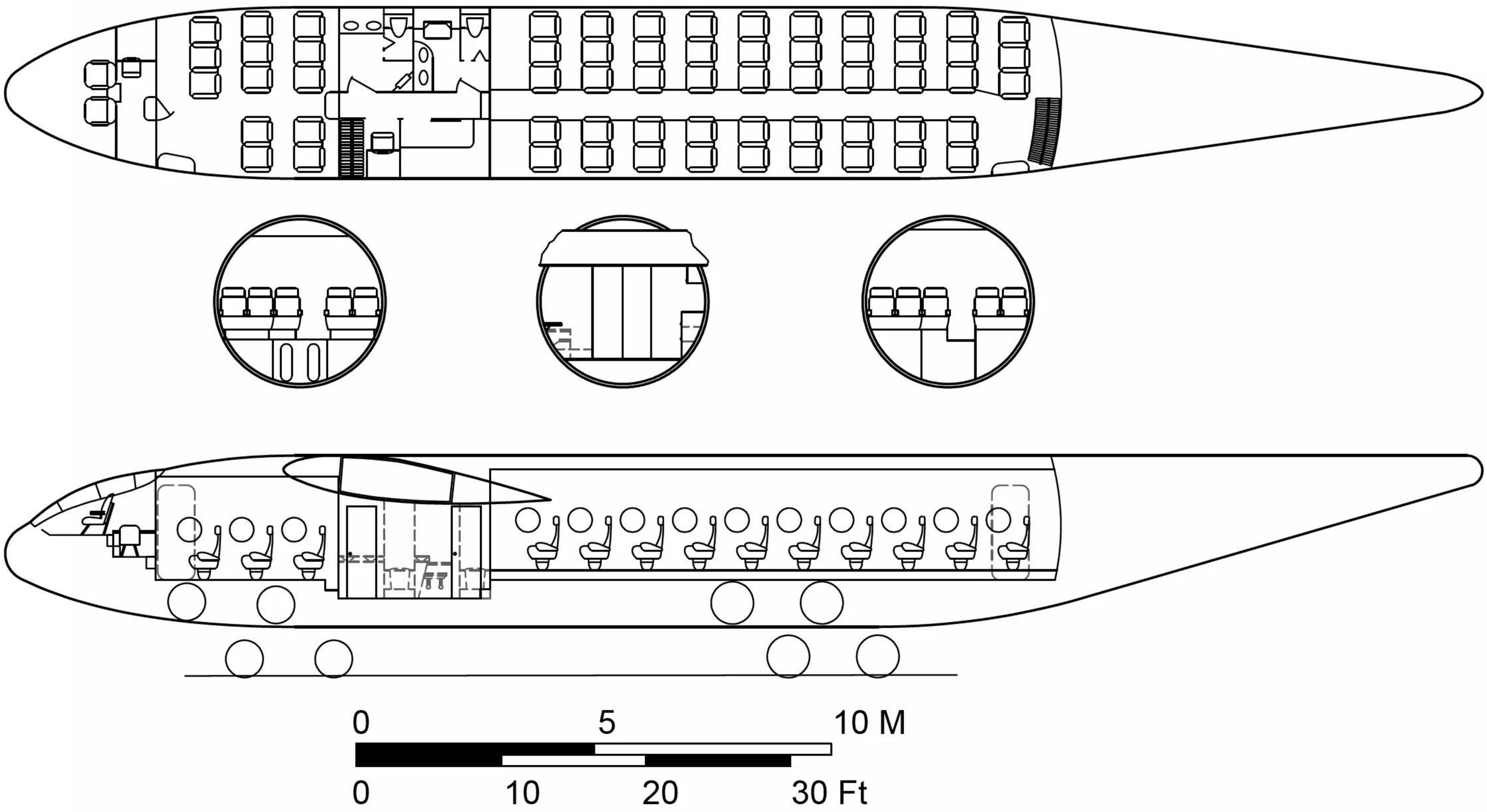
Boeing Model 473-31

SCALE 1/200



Boeing Model 473-31

SCALE 1/165



The Model 473 design series would go one from here, continuing to at least Model 473-65 from December 1950. The designs would cover considerable ground, including turboprops as well as jets, but were no longer beholden to the B-47 or B-52 for their design features or inspirations.

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General data table

Aircraft	Source Grade	Crew	Span	Wing area (sq ft)	Length	Engines	Dry weight (lbs)	Design Fuel (lb)	Design Payload (lbs)	Max Payload (lbs)	Gross weight (lb)	Range (n.mi.)	Cruise speed	Max speed	Ceil-ing (ft)
B-47 development															
Focke-Wulf mit 2 HeS 109-11	4	1	41’ 6”	290.63	46’ 7”	2 HeS 109-11	9,259	6,172	2,204		17,857		559 to 621 mph		
Boeing Model 413	3	3	140’	1,867	108.67’	4 GE TG-180	49,180	26,962			77,700				
Boeing Model 422	3	4	139’ 6.8”	1,804.5	110’ 9”	2 turboprops									
Boeing Model 424	3	4	115’	1,100	91’	4 GE TG-180	42,155				80,000				
Boeing Model 425	3	4	139’ 6.8”	1,867	108’ 6”	4 GE TG-180									
Boeing Model 426	3	4	114’ 7.74”		91’	2 turboprops									
Boeing Model 432	3	4	113’ 8”	1,300	101’ 8”	4 GE TG-180	56,295	33,047	8,432	18,000	100,000				41,700
Boeing Model 444	3		106’ 1”		90’ 10”	2 turboprops									
Boeing Model 446	2	4	113’ 8”	1,300	101’ 8”	4 GE TG-180 + 2 turbojets									
Boeing Model 432-swept wing	2	4			101’ 8”	4 GE TG-180								550 mph	
Boeing Model 448	4	3	100’	1,300	109’ 3”	6 GE TG-180	77,517	37,455	8,430	22,000	125,000			555 mph @ 35,000 ft	
Boeing Model 450-1-1	3	3	100’	1,300	108’ 1”	6 GE TG-180	75,186		8,585		125,000	4,100	560 mph @ 25,000 ft	640 mph @ 25,000 ft	36,000
Boeing Model 450-2-2	3		116’		106’ 9.2”	6 GE TG-180									
Douglas XB-43	3	3	71’ 2”	562.5	51’ 5”	2 GE TG-180 (J35)	21,775		8,000		39,533	2,840	420 mph	515 mph @ SL	38,500
Douglas B-43	3	3	71’ 2”		51’ 2”	2 GE TG-180 (J35)									
Curtiss-Wright XA-43	3	3	73’	666	67’ 6”	4 Westinghouse 24-C turbojets		19,000	6,000		56,300	2,094	520 mph at 30,000 ft	612 mph at 5,000 ft	
Convair XA-44	3		84’ 10.6”	1,200	69’ 5”	3 GE TG-180 (J-35)	29,522		6,236		58,000	1,550		583 mph @ 10K ft	44,000
North American XB-45 (data B-45A)	4	4	89’	1,175	75.3’	2 J47-GE-7+ 2 J47-GE-9 or -15	45,694	5,746 gal	8,000	22,000	91,775	1,036	377 @ 38-43 kft	492 kts @ 4,000 ft	46,000
North American B-45A	3	4	89’	1,175.2	75.3’	2 J47-GE-1+ 2 J47-GE-3	45,206	4,600 gal	10,000		88,400	1,439	393 knots @ 38K ft	504 kts @ SL	42,100
Convair XB-46	3	3	113’	1,285	105’ 9”	4 GE J35	43,436	35,360	8,964		89,770	2,870	439 mph	545 mph	40,000
Matin 223-1	3	3	104’			4 TC-180 turboprops			8,000						
Matin 223-2	3	3	104’			4 Turbojets				12,000					
Matin 223-3	3	3	104’			4 Turbojets				15,000					
Matin 223-4	3	3	104’		71’ 10”	4 Turbojets				16,000					

Aircraft	Source Grade	Crew	Span	Wing area (sq ft)	Length	Engines	Dry weight (lbs)	Design Fuel (lb)	Design Payload (lbs)	Max Payload (lbs)	Gross weight (lb)	Range (n.mi.)	Cruise speed	Max speed	Ceil-ing (ft)
Matin 223-5	3	3	104’		78’ 7”	4 Turbojets									
Matin 223-6	3	3	104’ 2”		82’ 2”	4 Turbojets									
Matin 223-7	3	3	104’		82’ 2”	4 Turbojets									
Matin 223-8	3	3	104’		82’ 2”	4 Turbojets									
Matin 223-9	3	3	104’		82’ 2”	6 Turbojets									
Matin 223-10	3	3	104’		81’ 8”	4 Turbojets									
Matin 223-11	3	3	98’ 6”	1,100	82’ 8”	6 GE TG-180 tur-bojets	51,884				99,500				
Matin 223-12	3	3	98’ 6”		85’ 2”	6 GE TG-180 tur-bojets									
Martin XB-48	4	3	98’ 6”	1,104	86’ 7”	6 GE TG-180 tur-bojets	51,884		10,000	22,000	99,500	1,566	361 knots	454 kts	39,400
Lockheed L-173	3	8-10	173’	2,000	128’ 6”	6 Westinghouse XJ40-6			10,000	40,000	240,000	4,765	413 kts	530 kts at sea level	45,800
Douglas Model 1126	4	6	102.2’		119.9’	6 Westinghouse XJ40-WE-6									
Northrop N-31	4		1540”	3,070	889”	6 Westinghouse X40E2						2,781	520 mph		
Northrop N-31A (2 eng)	4		128.33’		74.67’	2 Turbodyne XT-37					161,540	2,400 radius	450 knots		
Northrop N-31A (4 eng)	4		128.33’		74.67’	4 Allison XT-40					175,400	2,400 radius	440 knots		
Republic AP-42	2		~136’ 3”		~150’	8 Turbojets									
RAND G-2	3	6	141’	4,000	86.5’	4 turboprops		25,000 gal	10,000		300,000	8,000	525 mph		
450-3-3 XB-47	4	3	116’	1,428	105.5’	6 General Electric J35-GE-7	74,623	9,957 gal		22,000	162,500	2,300	462 kts @ 35 kft	502 kts @ 15 kft	37,500
B-47A	4	3	116’	1,428	108’ 0”	6 General Electric J47-GE-11	73,149	9,789 gal	10,000	22,000	150,500	2,648	490 kts @ 35 kft	536 kts @ 10,500 ft	43,800
B-47B	4	3	116’	1,428	106.7’	6 General Electric J47-GE-11	77,830	12,770 gal	10,000		181,440	3,360	486 kts @ 35 kft	537 kts @ 1,800 ft	41,500
Boeing Model 450-16-17	4	3	116’	1,602	106’ 10.2”	4 Westinghouse XJ40-WE-6	73,400	99,290			125,000	2,270 radius	432 knots	485 kts @ 35 kft	40,600
YB-56/ B-47C	3	3	116’	1,428	106.7’	4 Allison J35-A-23	75,250	13,583 gal	10,000	25,000	185,000	4,225	426 knots		
Boeing Model 450-155-33	4	4	116’	1,570	109’ 5”	4 Pratt & Whitney J57-P-1W	86,800				125,000			510 mh @ 42,800 ft	
B-47C/B-47X	2	4	116’	1,570	109’ 5”	4 Pratt & Whitney J57-P-1W									
Boeing Model 450-166-38	3		116’	1,920	107.1’	4 Pratt & Whitney J57-P-1W	81,910	18,011 gal	10,000		221.090	2,900 radius	486 knots @ 45,050 ft	531 kts at 15 kft	38,000
Boeing Model 450-9-3	3	3	116’	1,300	107’ 5.6”	4 Allison Model 500 Turboprops	75,940	81,060	10,000		157,000				

Aircraft	Source Grade	Crew	Span	Wing area (sq ft)	Length	Engines	Dry weight (lbs)	Design Fuel (lb)	Design Payload (lbs)	Max Payload (lbs)	Gross weight (lb)	Range (n.mi.)	Cruise speed	Max speed	Ceil-ing (ft)
Boeing Model 450-30-10	4	3	116’	1,428	106’ 10.2”	4 Allison T-40-A-8 turboprops	81,180	93,040			180,000		473 mph		
Boeing Model 450-31-10	4	3	116’	1,428	106’ 10.2”	4 Allison T-40-A-8 turboprops	76,190	91,464			180,000	5,690	460 mph		
Boeing Model 450-32-10	4	3	116’	1,428	106’ 10.2”	2 P&W J57 plus free turbine	85,350	81,160			180,000	6,040	480 mph		
Boeing Model 450-33-10	4	3	116’	1,428	106’ 10.2”	2 P&W JT-3A turbo-props	84,840	74,724			180,000				
Boeing Model 450-59-10	4	3	116’	1,428	106’ 10.2”	4 Allison T-40-A-8 turboprops	78,070	89,190			180,000	5,986	465 mph	490 mh @ 41,300 ft	
Boeing Model 450-60-10	4	3	116’	1,428	106’ 10.2”	4 P&W PT-2E Tur-boprops	74,730	92,530			180,000	6,100	455 mph	483 mph @ 35,100 ft	
B-47D	3	3	116’	1,428	106.8’	2 Wright YT49-W-1 2 GE J47-GE-23	79,800	13,979 gal	10,000		184,428	2,717 radius	479 knots @35kft	519 kts @ 13,500 ft	41,500
B-47E	4	3	116’	1,428	107.1’	6 General Electric J47-GE-25	79,074	18,000 gal	10,000		230,000	1,780 radius	491 knots @ 35 kft	497 kts @ 20 kft	31,500
RB-47E		3	116’	1,428	109’ 8”	6 General Electric J47-GE-25	81,100	18,280			202,000	1,915 radius	433 knts @ 30,100 ft	465 kts @ 39,200 ft	31,500
Boeing Model 450-36-10	4	3	155’	1,650	106’ 10.2”	4 Allison J35-A-23	75,350	91,104			208,000	5,880	480 mph		
Boeing Model 450-57-10	4	3	145’	1,602	106’ 10.2”	4 Allison J35-A-23	86,670	120,507			220,000	5,840	480 mph	503 mph	
Boeing Model 701-333	3		81’ 4”		123’ 4”	4 General Electric J79					148,300				
Boeing Model 450-65-10A	4	3	87’ 6”	2,190	106’ 10.2”	4 P&W XJ-57-P5 w/ afterburners	85,680				180,000				
Boeing Model 450-65-10C	4	3	87’ 6”	2,190	113’ 1.7”	4 P&W XJ-57-P5 w/ afterburners									
Boeing Model 450-65-10F	4	3	116’	2,530	113’ 1.7”	4 P&W XJ-57-P5 w/ afterburners	91,370				180,000				
Boeing Model 450-151-31	4		87’ 6”	2,190	124’ 7”	4 P&W J57-P1 w/ afterburners	89,490		9,600		200,000				
Boeing Model 450-152-27	4		87’ 6”	2,100	110’ 11”	4 P&W J57-P1 w/ afterburners	77,400		10,000		180,000	4,500			
Boeing Model 450-154-32	4		87’ 6”	2,100	123’ 8”	4 P&W J57-P1 w/ afterburners	82,880		10,000		180,000	4,026			
Boeing Model 450-139-10	4		116’	1,428	106’ 10.2”	6 Allison Model 509 Fan Jets	73,400	82,730			180,000	3,940	490 mph	520 mph @ 42,350 ft	
Boeing Model 450-148-30	4	5	116’	1,428	106’ 4.1”	2 T-49 turboprops 2 J67-WI turbojets	88,280	61,870	16,000		170,000	2,400		600 mph at sea level	36,500
Boeing Model 450-150-30	4	5	116’	1,428	106’ 4.1”	4 Westinghouse J40-WE-6	73,400	60,270	16,000		168,200	2,400		600 mph at sea level	36,500

Aircraft	Source Grade	Crew	Span	Wing area (sq ft)	Length	Engines	Dry weight (lbs)	Design Fuel (lb)	Design Payload (lbs)	Max Payload (lbs)	Gross weight (lb)	Range (n.mi.)	Cruise speed	Max speed	Ceil-ing (ft)
LAMP LIGHT	3		116’	1,428		6 General Electric J47-GE-25			11,200		220,000	2,700	360 kts @ 23-40 kft		
All American Eng Pusher	3	1	~51.75’		~59.3’	4 Turbojets (J47?)									
Goodyear Composite Aircraft	1	2(?)	~109.6”		~66.9”	4 Turbojets (J47?)									
B-36+B-47 Tip tow	2		462’												
499-1	3	5	170’	9,350	98’ 6”	4 P&W J57-P-5		15,954 gal			180,000			631 mph @ 22 kft	
GAM-67 Crossbow	3	3	12’ 7.8”		20’ 0.2”	1 Continental J67-T-17 turbojet					2700	300	Mach 0.86		40,000
DB-47E RASCAL	3	3	16.7’	114.65	32’	1 Bell LR 67-BA-9	5,857	287 gal (Fuel) 586 gal (Oxy)	2810		18,169	90		Mach 2.84 @ 70 kft	70,000
DB-47E Bold Orion	2	3	~80.5”		~31.9’	1 Thiokol TX-20 Sargeant 1 ABL X-248 Altair						1,100			160 n.mi.
Canadair CL-52	3	3	116’	1,428	106.7’	6 General Electric J47-GE-11 + 1 Orenda Iroquois									
Model 473-10	3	3	100’	1,000	82’ 3”	2 Nene turbojets	34,160	2,620 gal	28 pax		50,000				
Model 473-13	4	3+	100’	1,000	87’	4 Westinghouse 24C-10 turbojets	35,960	18,880	36 pax		63,000				
Model 473-14	4	3	100’	1,000	89’ 8”	4 Westinghouse 24C-10 turbojets	36,540	17,880	40 pax/ 27,380 lbs		64,900			535 mph at 35 kft	
Model 473-14N	4		100’	1,000	89’ 8”	4 Westinghouse 24C-10 turbojets									
Model 473-23	3		116’	1,575	100 ft	4 P&W J57 turbojets	74,450	59,620	36 pax/ 8,700 lbs		145,000	5,215	500 mph at 47,000 ft		
Model 473-27	3		101.5’	1,200	94.5’	4 WE-24C-10 tur-bojets	43,910	25,070	52 troops	20,000	90,000	2,090	500 mph at 40,000 ft		
Model 473-28B	3		101.5’	1,200	94.5’	4 WE-24C-10 tur-bojets	45,310	20,500	36 pax	1,520	75,000	1,985	500 mph at 40,000 ft		
Model 473-30	3		146.5’	2,500	114’	4 Westinghouse XJ-40-WE6	87,530	54,000	70 pax/ 14,000 lbs		170,000	4,293	500 mph at 49,000 ft		
Model 473-31	3		113’ 6”	1,500	103.1’ (fuse-lage)	4 5,2000 lbf turbojets	58,340	23,400	61 pax/ 12,200 lbs		94,000	2,250	500 mph at 46,000 ft		
M-61 gunship															
Nuclear B-47 (N-20)	2	3	116’	1,400	108’	4 nuclear XJ-53 turbojets		10,600	10,950		250,000			545 mph @ 20K ft	33,500

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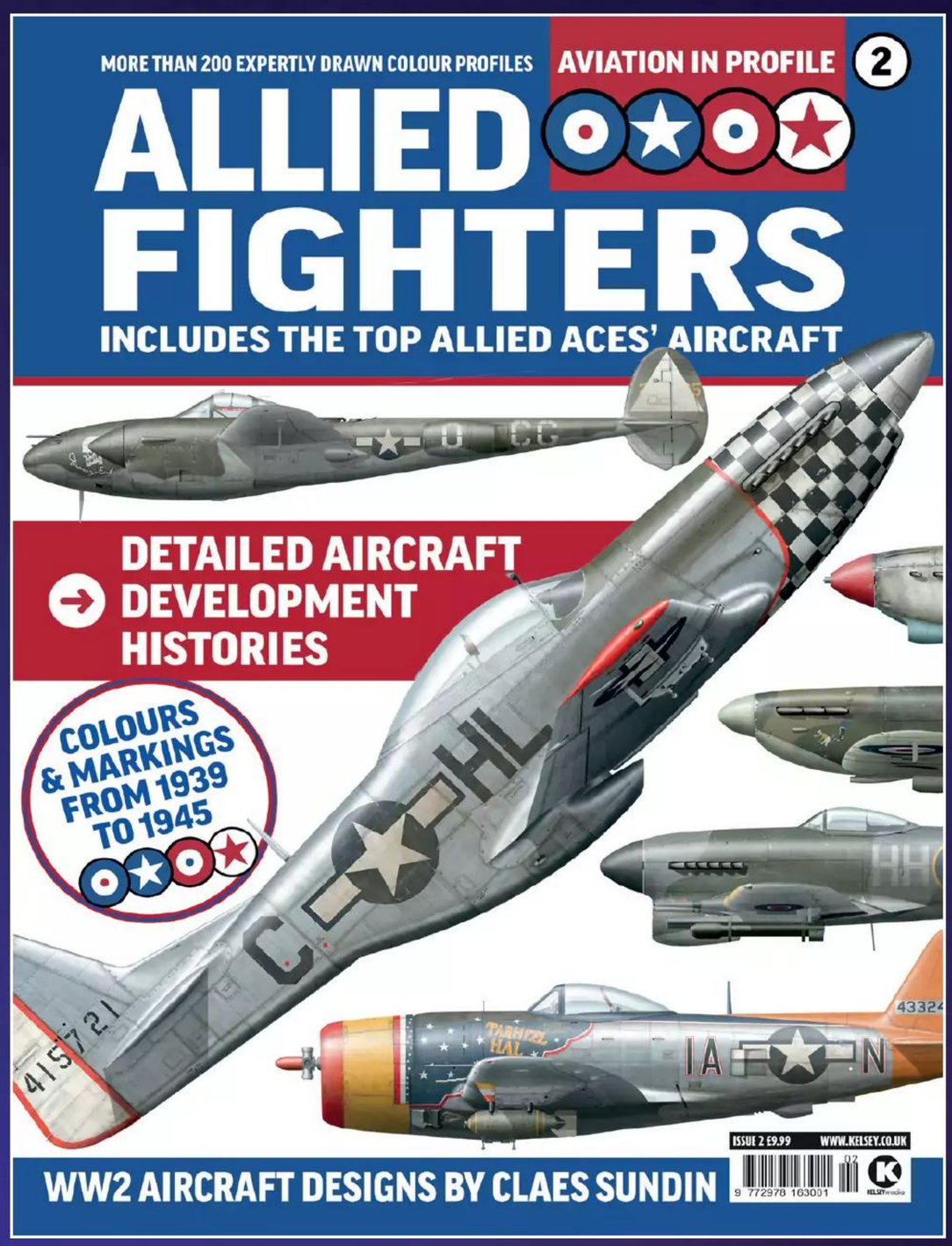
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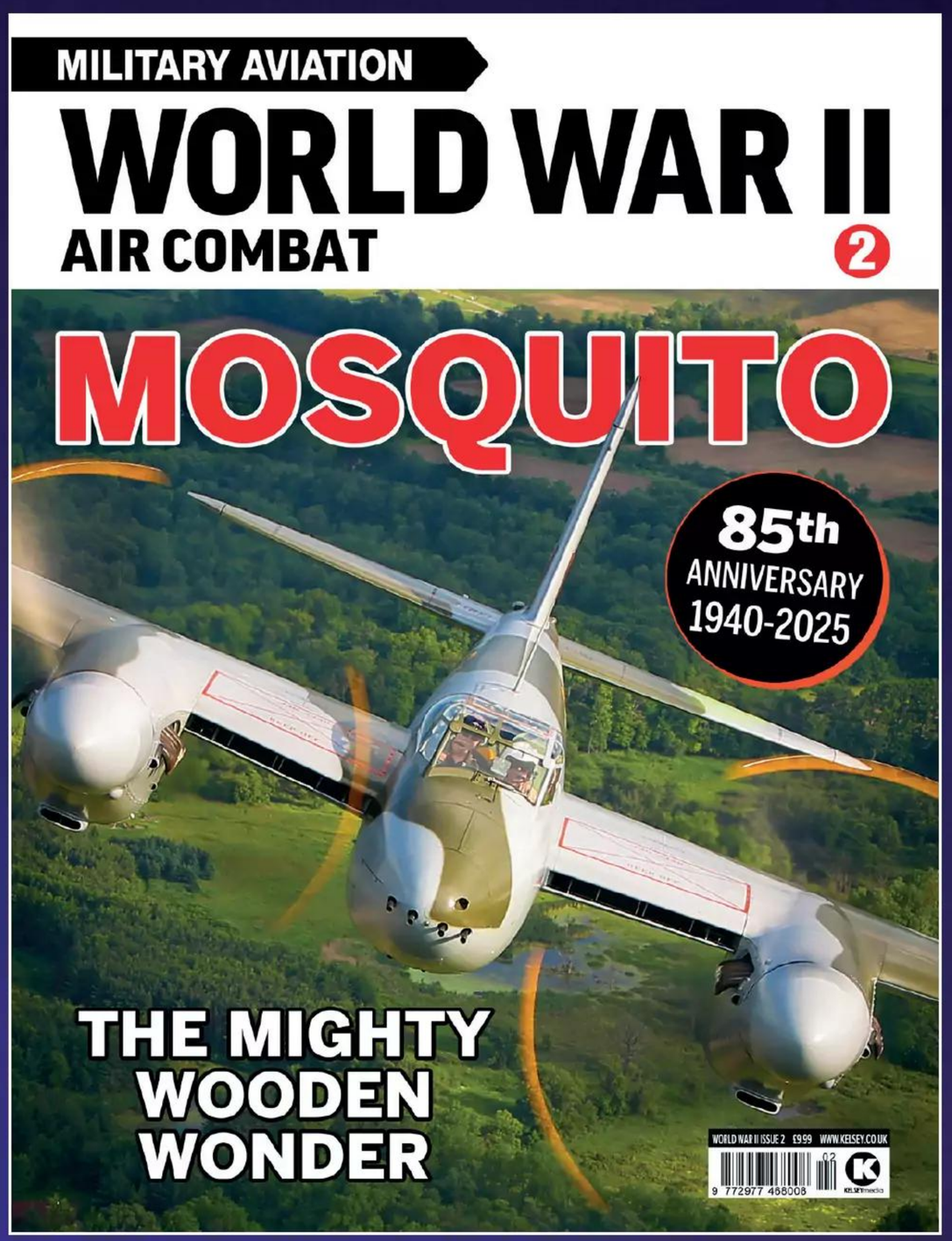
World War II Air Combat



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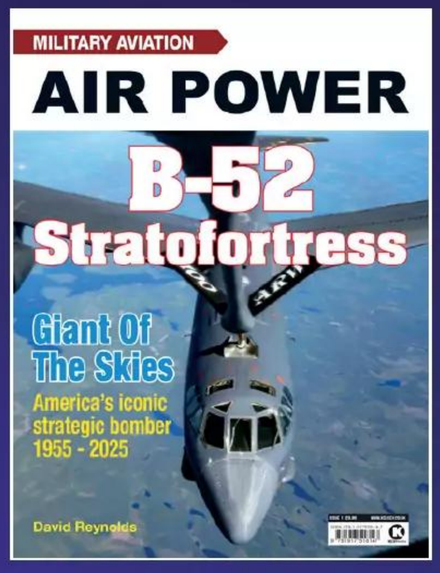

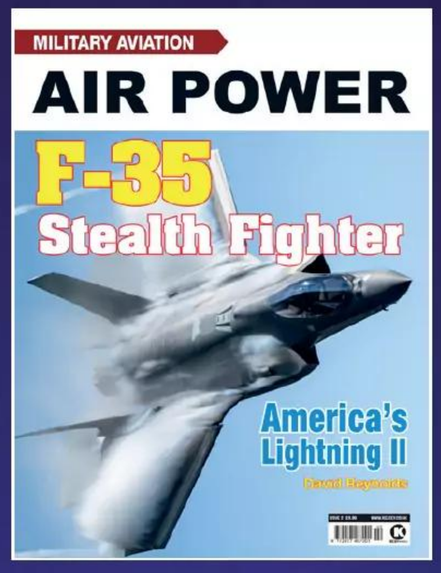

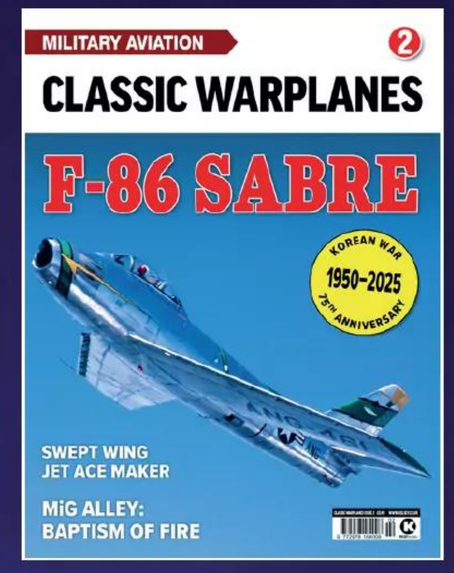

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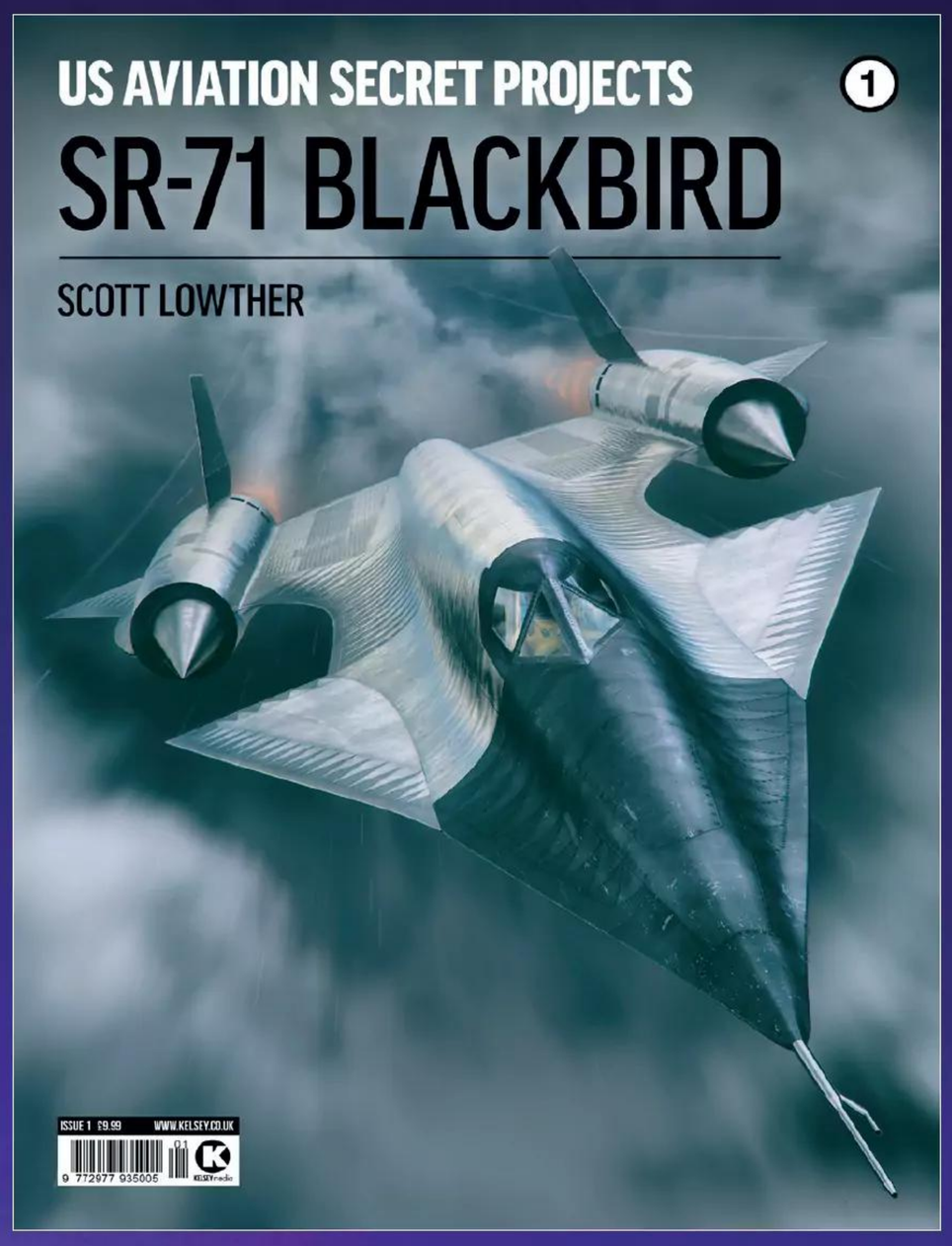

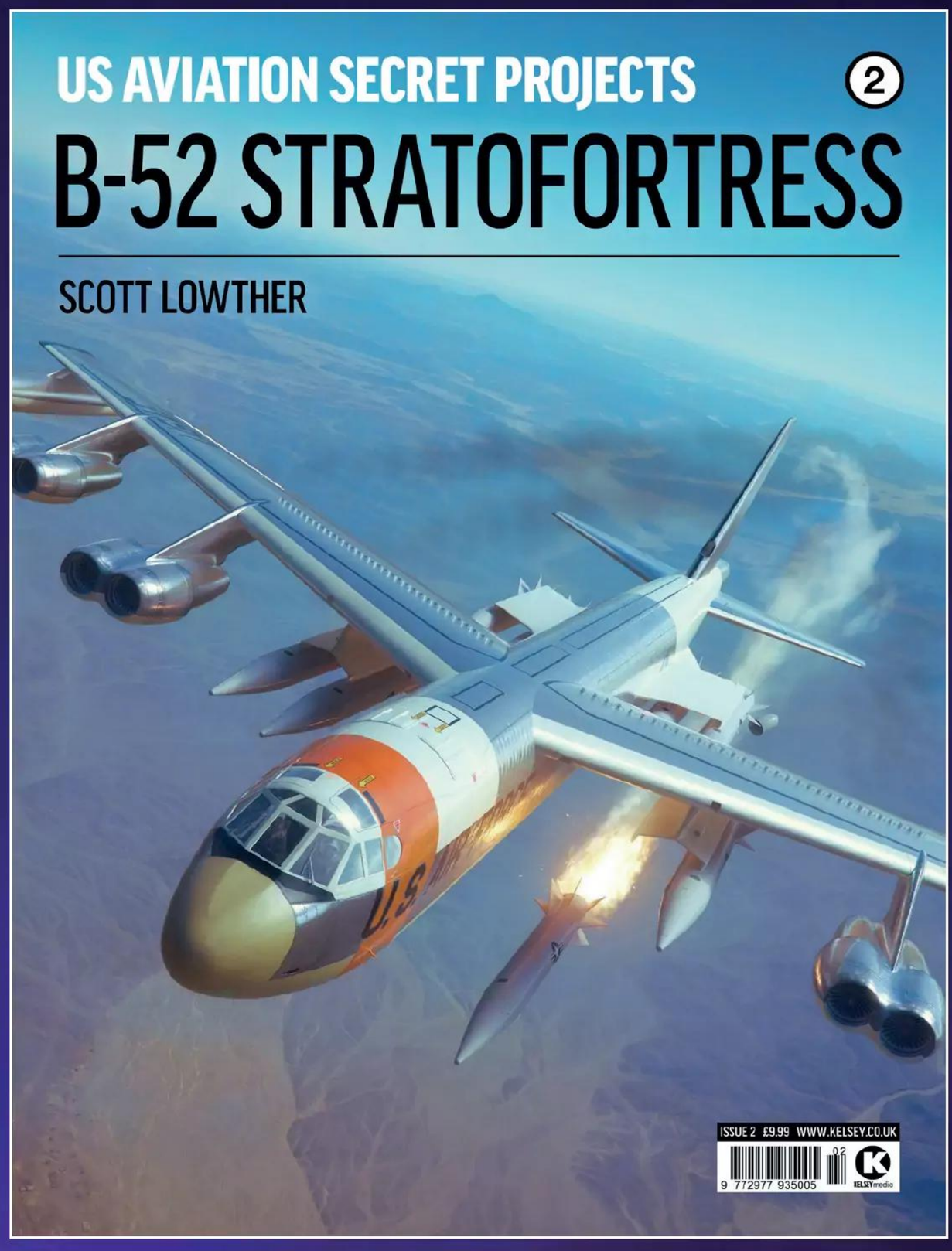

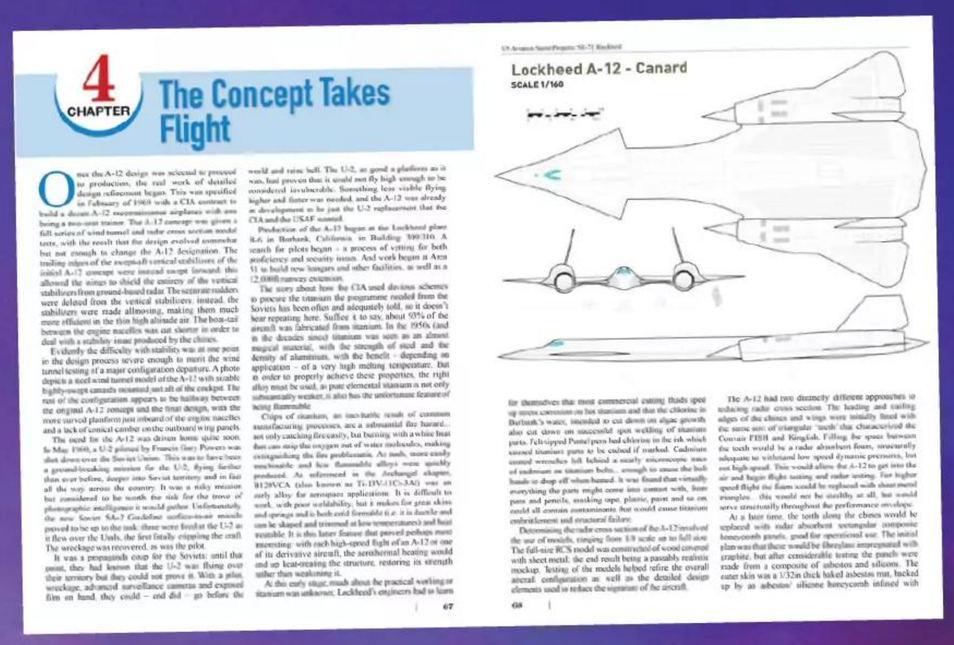

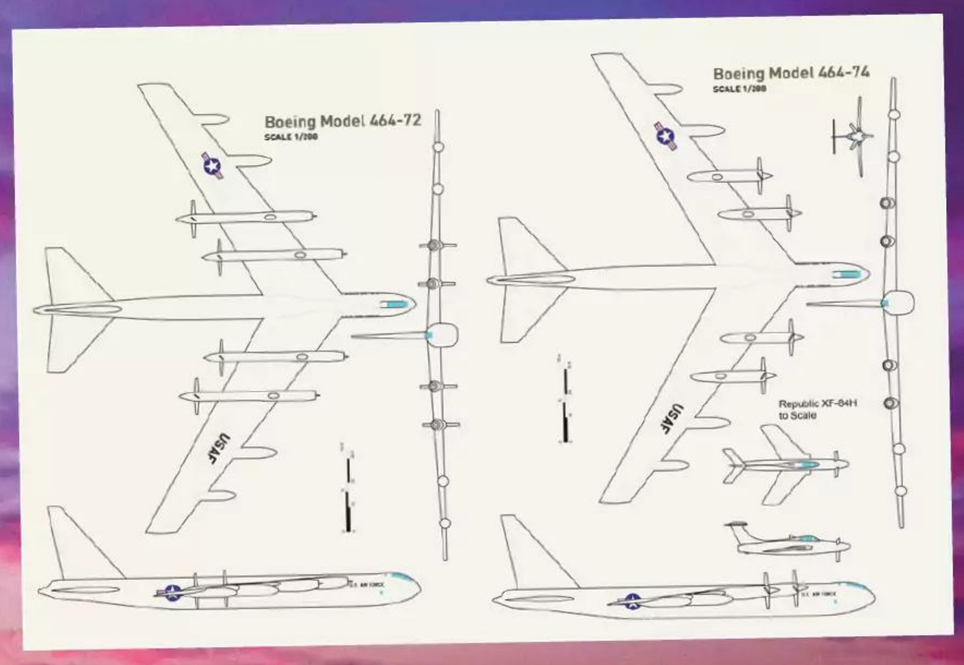

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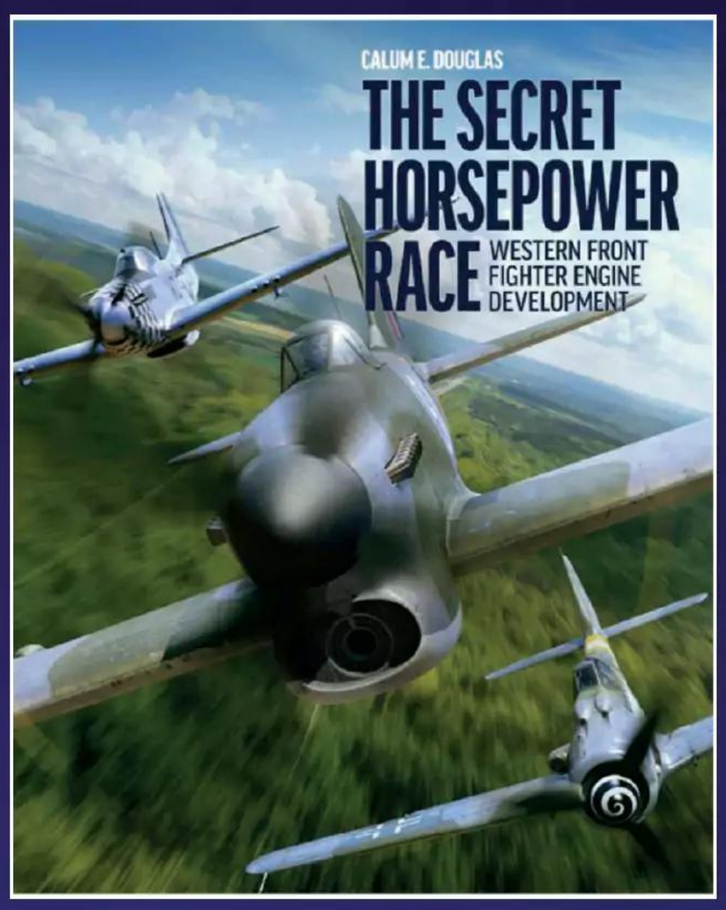

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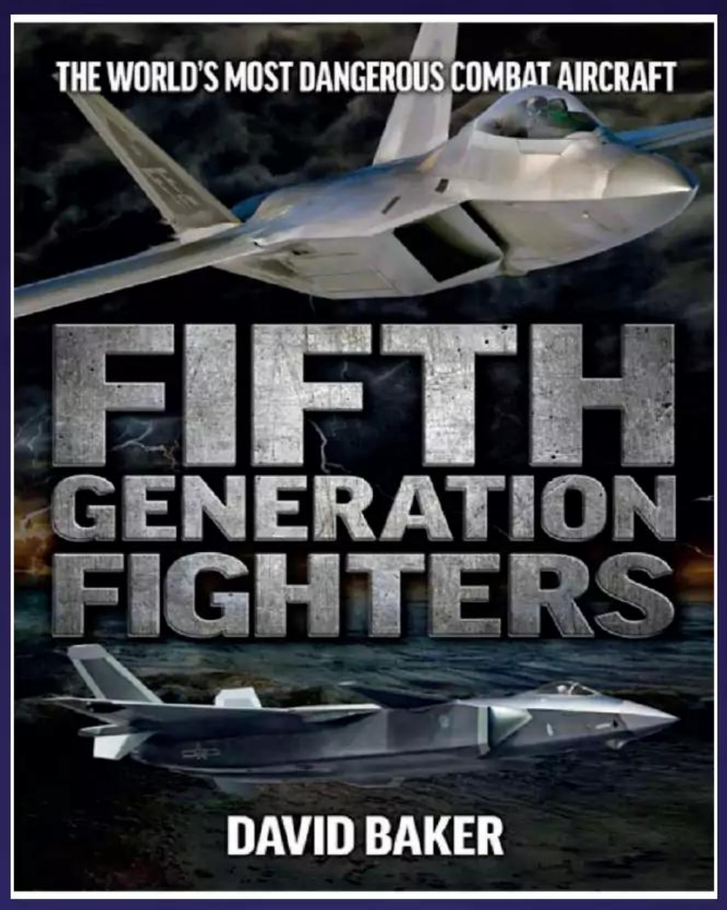

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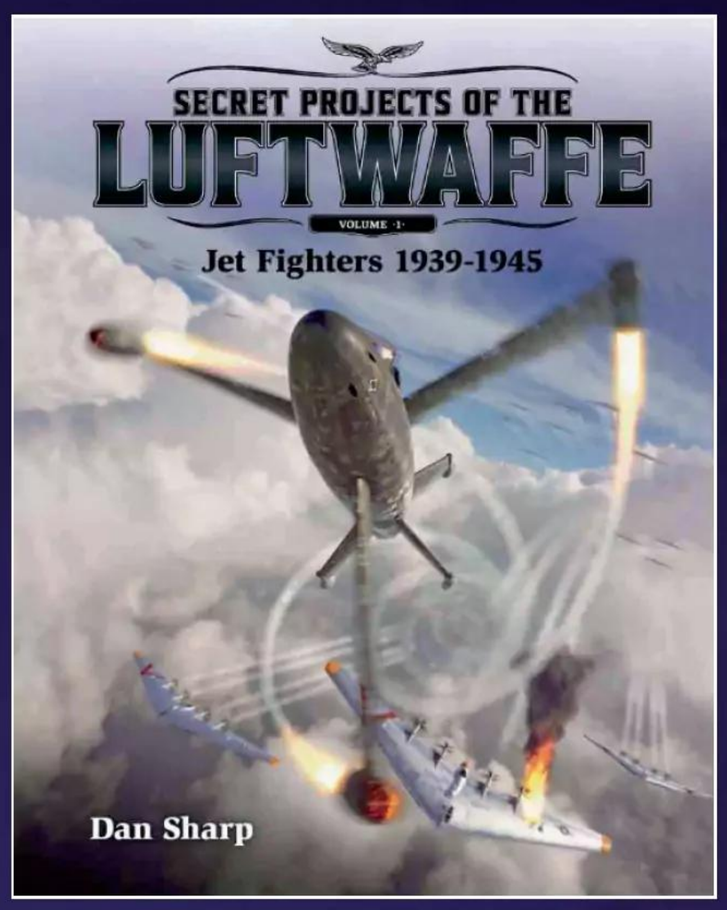

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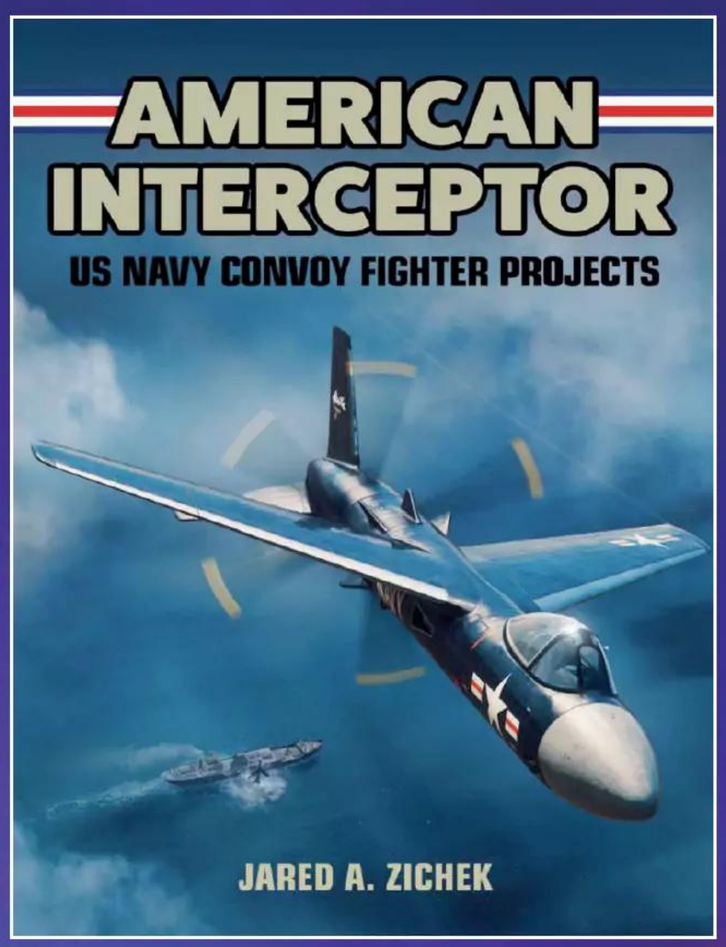

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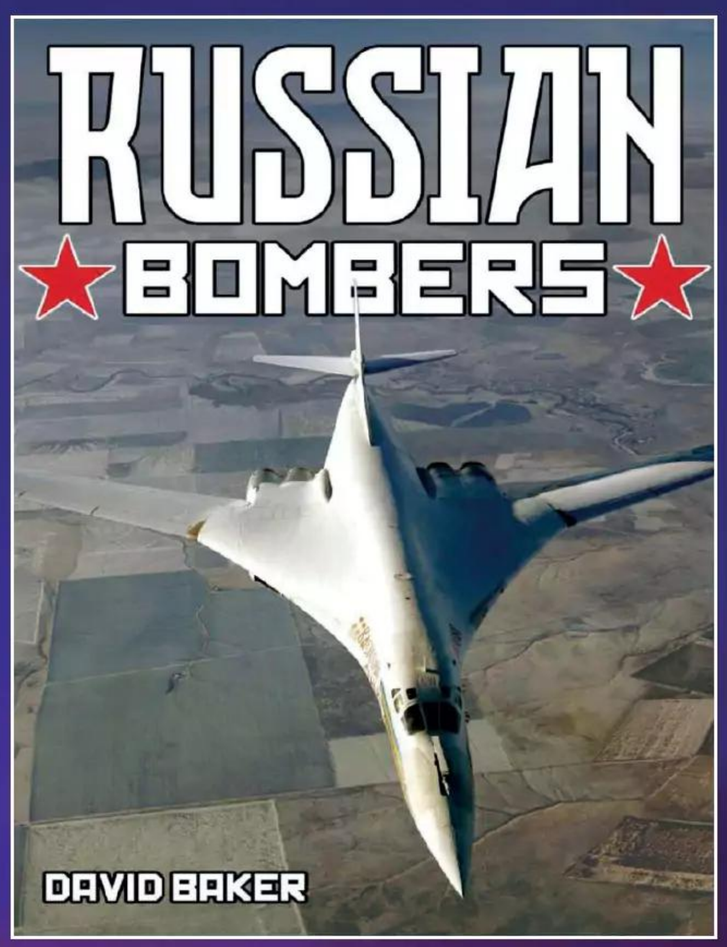

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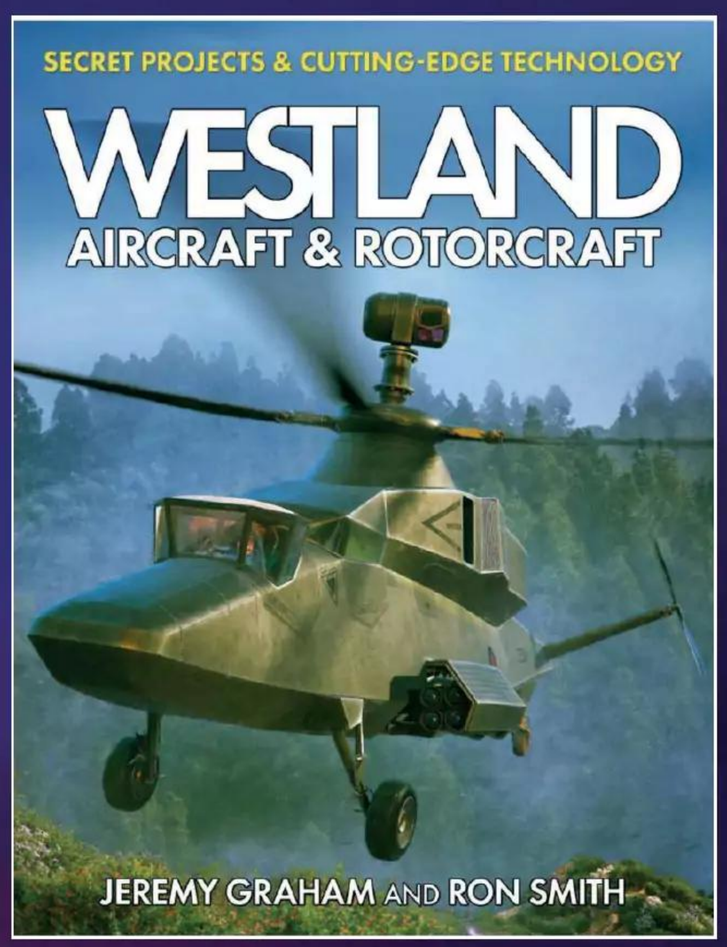

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